

TECHNOLOGY DEPT.

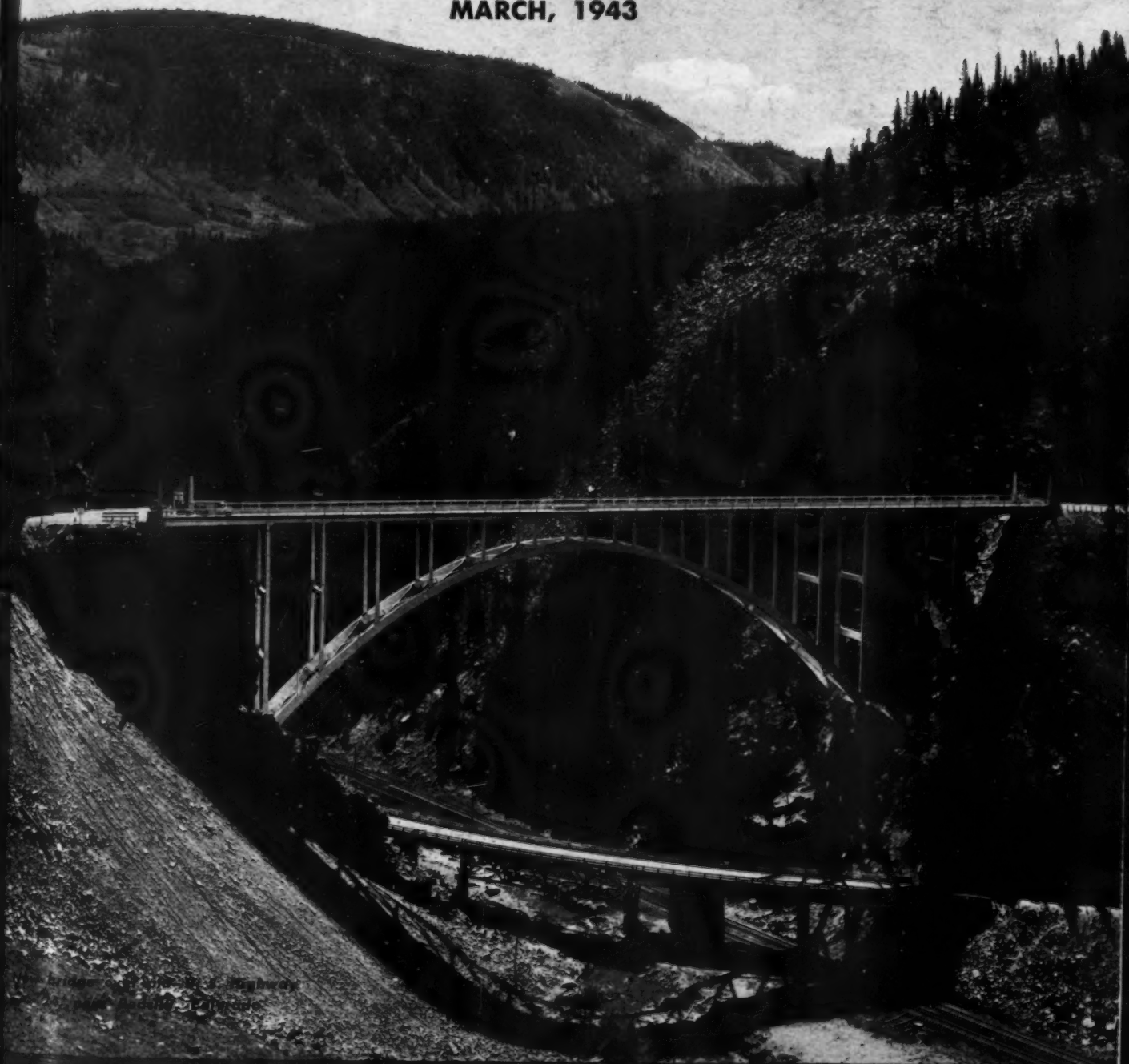
# ROADS AND STREETS

PUBLIC LIBRARY

MAR 22 1943

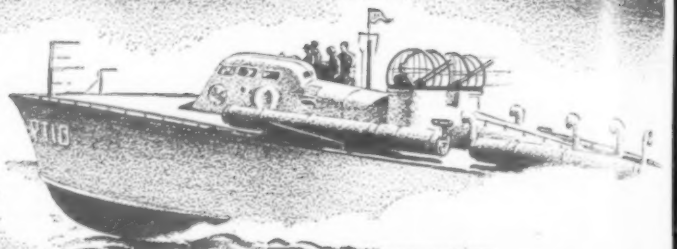
DETROIT

MARCH, 1943



**In This Issue:** Big Midwest Airport Job—Developments in Flexible Pavement Foundation Design — North Atlantic States Conference Report — Wayne County's Spot Maintenance Methods — State Street Paving, Chicago — War-Time Shovel Overhaul

# SPEED



## TO KEEP YOUR GRADERS ROLLING FOR VICTORY...

- ✓ Check condition of engine regularly.
- ✓ Change lubricating oil and renew filter elements every 100 hours of use.
- ✓ Lubricate all parts of grader regularly.
- ✓ Service air cleaner every 10 hours of use.
- ✓ Clean fuel oil filters at least every 60 hours.
- ✓ Don't ride clutch. Adjust clutch pedal when and as needed.
- ✓ Keep electrical system in good condition—check battery regularly.
- ✓ Keep lost motion out of grader—use adjustments for wear and replace parts worn out.
- ✓ Keep tires inflated to recommended pressure.

*If you need help or advice on any of the above, see your local Adams distributor.*

★ Just as SPEED allows PT boats to roar in, do their jobs and get away quickly so their high transport speeds and wide range of working speeds enable Adams Motor Graders to get to a job quickly, finish it in a hurry, and get on to the next with minimum loss of valuable working time . . . SPEED is but one of the features of Adams Motor Graders that will help you to complete your jobs quickly, economically and profitably!

### J. D. ADAMS COMPANY • INDIANAPOLIS, INDIANA

*Adams motor graders, leaning wheel graders, elevating graders, hauling scrapers, tamping rollers, bulldozers and road maintainers are used by allied forces throughout the world.*

# Adams

ROAD-BUILDING AND  
EARTH-MOVING EQUIPMENT



# 4 WAYS

## to get more service from WIRE ROPE

Yes, wire rope is tough. It can stand up to the most rigorous service—and ask for more.

But that's no reason to abuse it. With a little care, by applying a few simple rules, you can get a tremendous amount of extra service from your rope.

### 1 Break it in with light loads

For example, when breaking in a new rope, don't slam on full power and speed right off the bat. Begin with fairly light loads. Operate at moderate speed. Give the strands of the rope a chance to seat down snugly and uniformly upon the core, so that each strand is carrying its fair share of the load. This way, the rope will assume its proper "constructional stretch" without damage, and you'll be assured of better spooling and easier handling throughout the entire life of the rope.

### 2 Treat it with consideration

After the rope is broken in, you can safely use whatever speeds and loads it was designed for. But don't be unnecessarily rough, even then. A smooth, gradual application of power is just as efficient as slamming into the load

with a jerk. The same is true of braking. It's the heavy jerks and surge loads that beat the guts out of a piece of rope. Nine times out of ten these can be avoided without losing time.

### 3 Know your rope

For example, if you're using a flexible 8-strand rope for high-speed work, don't overload it. This rope is built to withstand bending fatigue and fast operation—not for heavy hogging lifts. The opposite is true of heavy-duty 6-strand rope. Lift with it—but don't try to break speed records.

### 4 Right maintenance means plus service

Don't neglect the few simple maintenance precautions which require so little time yet return so much in extra service. Keep your rope properly lubricated. Don't operate it over sheaves that are abraded, damaged, or out of line. Fasten clips in the approved manner. Cut off a short length from the drum end of your rope from time to time so that "grief spots" are relocated over sheaves and drums.



*Wire rope is now a war weapon. Its proper use is a service to your country and to yourself. If you want good, dependable rope, and friendly service, get in touch with the Bethlehem Wire Rope distributor in your territory. He's always ready and willing to serve you.*

**Bethlehem Manufactures Wire Rope for all Purposes**

# ROADS AND STREETS

Vol. 86, No. 3

March, 1943



*A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; and to the construction and maintenance of airports.*

WITH ROADS AND STREETS HAVE BEEN COMBINED GOOD  
ROADS MAGAZINE AND ENGINEERING & CONTRACTING

## CONTENTS

Speed in Spite of 86 Rainy Days.....	37
Design of Flexible Pavement Foundations.....	44
By T. A. MIDDLEBROOKS Chief Soil Mechanics Unit, Office of Chief of Engineers, Washington, D. C.	
The Cause of the Sun's Heat.....	49
By HALBERT P. GILLETTE	
North Atlantic Conference Looks to Post-War Needs... ..	52
Maintaining Michigan Highway and Street Service During the War Period.....	56
Texas Road Built by Day Labor with Home-Made Equipment .....	57
425° Spot Treatment in Wayne County.....	63
Asphalt Pavement on State Street, Chicago.....	64
Built 1921—Rebuilt 1941.....	67
By EARL CAPEL District Engineer, Iowa State Highway Commission	
Construction Equipment Maintenance.....	71
How Eastern Equipment Distributor Is Aiding War Program By HAROLD J. McKEEVER Associate Editor, Roads and Streets	
All Work and No Care Makes a Dull Jack.....	78
By F. J. JAKOUBEK Chief Engineer, Templeton, Kenly & Co., Chicago	
With the Manufacturers.....	82
New Equipment and Materials.....	86
Coronach .....	89
Personal Items About Engineers.....	91
New Trade Literature.....	95

Published by Gillette Publishing Co. Acceptance under the Act of June 5, 1934, authorized January 25, 1938, at Chicago, Illinois. Subscription price \$3.00 per year in the United States, \$3.40 per year in Canada, \$4.00 per year for foreign mailing.

### STAFF

HALBERT P. GILLETTE, Editor-in-Chief

EDWARD S. GILLETTE,  
Editor and Publisher

CHARLES T. MURRAY  
Managing Editor

JOHN C. BLACK, Field Editor

HAROLD J. McKEEVER  
Associate Editor

MAJOR V. J. BROWN  
Publishing Director  
(Absent on Military Duty)

H. J. CONWAY  
Advertising Editor

### GILLETTE PUBLISHING COMPANY

330 S. Wells St., Chicago, Ill.

ESTABLISHED 1904

PUBLISHERS OF

ROADS AND STREETS

POWERS' ROAD AND  
STREET CATALOG

WATER WORKS AND  
SEWERAGE

CAMINOS Y CALLES

TECHNICAL BOOKS

### BUSINESS REPRESENTATIVES

#### Chicago Office

L. H. LINGNOR, Manager

E. C. KELLY

E. H. HICKEY

330 S. Wells St., Chicago, Ill.

Telephone: Harrison 1843

#### New York Office

J. M. ANGELL, JR.

155 East 44th St., New York, N. Y.

Telephone: MUrrayhill 2-6023

#### Cleveland Office

B. C. BRUMM

2825 Lakeland Ave., Lakewood, Ohio

Telephone: Lakewood 4466

#### Los Angeles Office

DON HARWAY & CO.

816 West Fifth St., Los Angeles, Calif.

Telephone: Mutual 8512

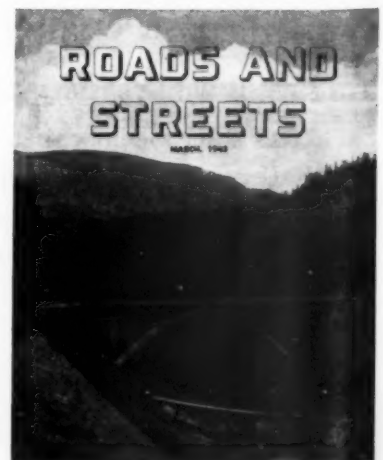


Photo by O. Roach, Denver

The bridge shown on the cover is 470 ft. long, 30 ft. wide and 209 ft. high—the final link in a 6-mile project built by the Colorado Highway Department at cost of \$700,000 over Battle Mountain, 26 miles northwest of Leadville.



# HERE'S AN ANSWER TO 1943's BIG QUESTION?

**SHOW 'EM  
YOU ARE  
CONSERVING**

Hundreds of operators on shovels, bulldozers, tractors, scrapers and trucks are proudly displaying this red, white and blue 5" diameter emblem. It means they are conserving their particular construction equipment, making it last longer. Won't you join their ranks? A postcard with your name and address will bring you one or more free emblems.

★ ★ ★

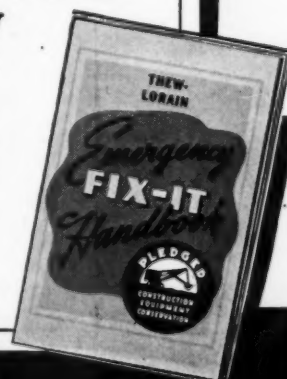
*If you can't get new equipment, you'll have to take care of what you have*

**I**T'S your problem and ours too! And it's got to be licked. Equipment must last longer—emergency repairs must be made quickly, with a minimum use of critical, hard-to-get materials.

This new Thew Emergency Fix-It Handbook will help many Lorain owners answer the problem. It's a handy repairman's guide, covering all Lorain Models. It describes practical methods for making emergency repairs and how to salvage worn or used parts.

*Your copy will be mailed the day we receive your request. Write for the Fix-It Handbook now!*

**THE THEW SHOVEL COMPANY  
LORAIN, OHIO**



**THEW-LORAIN** CRANES • MOTO-CRANES  
SHOVELS • DRAGLINES

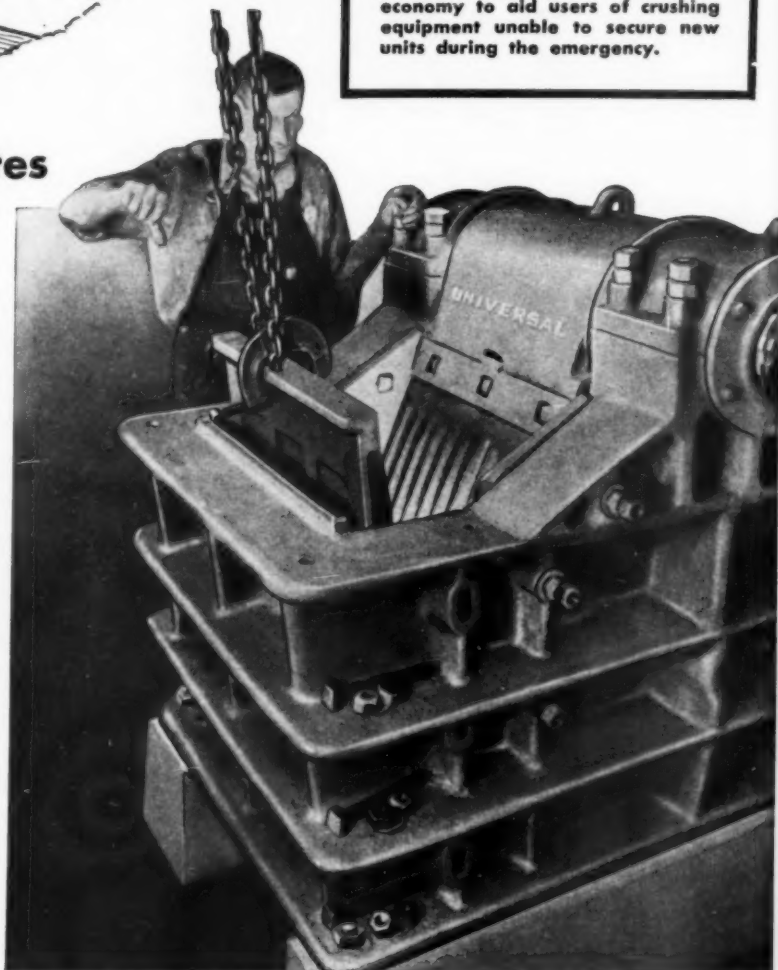
# The Care and Feeding of Rock Crushers



No. 2 of a series of advertisements in the interests of national economy to aid users of crushing equipment unable to secure new units during the emergency.

## Reverse Worn Jaw Plates for Maximum Service

Jaw plates are made reversible so they can be turned end for end when the lower end becomes worn. Jaw plates should be reversed as soon as they have become worn to a point of decreasing plant capacity—worn jaws will not grab and crush material. They cause material to slip and accelerate wear. Too, wear forms pockets at base of jaws preventing release of material and decreasing capacity. Cheek plates and wedges should be reversed, too (older models of equipment do not allow for this change) when jaws are reversed, for maximum efficiency and service.



## UNIVERSAL ENGINEERING CORP.

Formerly the Universal Crusher Co.

631 C Avenue West

CEDAR RAPIDS, IOWA

WE ARE HELPING

**ALL WAYS!**



We signed up early for the 10% War Bond Purchase Plan; we are building rock crushers and equipment for surfacing air base runways and we are army ordnance contractors.

*Nobody profits when jaws are worn like this!*



### Repair or Replace Jaws When Both Ends Are Worn

Most worn jaw plates can be salvaged by build-up welding and the use of filler bars. Only a few inches of jaw plate should be welded at a time to avoid warping the parent metal. Be sure to use a good manganese steel welding rod, applied in accordance with maker's recommendations.

We will be glad to recommend suitable welding electrodes, filler bars and best salvage welding methods on receipt of details covering type and make of equipment, nature of material worked and welding equipment available.

You boost production when you keep corrugations at the lower end of the jaws—you conserve vital metal when you build up worn jaws.

# UNIVERSAL

CRUSHERS, PULVERIZERS, COMPLETE PLANTS, SPREADEROLLERS, PORTABLE ASPHALT PLANTS



# GALION

ROAD ROLLERS  
MOTOR GRADERS  
SPREADERS



THE GALION IRON WORKS & MFG. CO., Main Office and Works, GALION, OHIO

# WEAKLINGS



Maintaining busy haul roads for trucks, equipment and supplies on an immense dam project. Run-offs for surface water were also built with this "99-M".

## IT TAKES A HUSKY...

... one you don't have to baby along—good at teamwork and at lending a hand—in *speeding up any task that comes along*. That's the type of performance you get with an all-wheel drive, all-wheel steer Power Grader—the "99-M". When you need more traction to move a bigger load, it's there. Just offset the frame so it operates like a tractor drawn grader. If side draft bothers the front end, it's easy to correct. Simply steer all wheels to concentrate power where support is needed and you counteract the thrust. If you want to utilize the full engine output where the going is tough, that's easy, too. Just distribute driving force along the entire blade and with a balanced load you go thru.

Like any other grader, the "99-M" drives from the rear and steers at the front, BUT—in addition, the front wheels also drive and the rear wheels also steer. Both ends can be controlled and both are equipped with live power. Working together as a balanced team, they increase the traction, stabilize the front end and utilize all the power. . . . Wherever a job is tackled—up on banks or slopes, in ditches or around curves (simple maintenance or heavy construction), you'll find thorough satisfaction with a "99-M". The Team-Work performance of the all-wheel drive and all-wheel steer makes any task easy. THE AUSTIN-WESTERN ROAD MACHINERY Co., Aurora, Illinois, U.S.A., Distributors in Principal Cities. Cable address AWCO, Aurora.



# DON'T WIN WARS



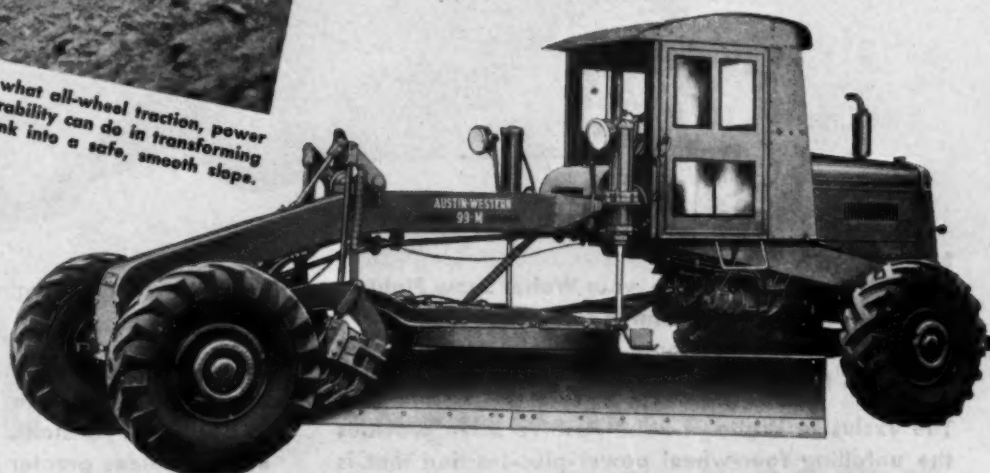
Building big airfields, where time is the essence of a contract, can be done with assurance when "99-M" capacity and dependability take hold and go to work.

## FOR THE DURATION . . .

. . . the output of "99-M's" has been earmarked for essential war use. If we can assist you on such work, or if we can service your present machines, it will be done in the best possible and most satisfactory manner. Austin-Western Distributors are accommodating and you can go to them with confidence. They know equipment and its operation and they have the tools and facilities to serve you well.



A sample of what all-wheel traction, power and maneuverability can do in transforming an eroded bank into a safe, smooth slope.



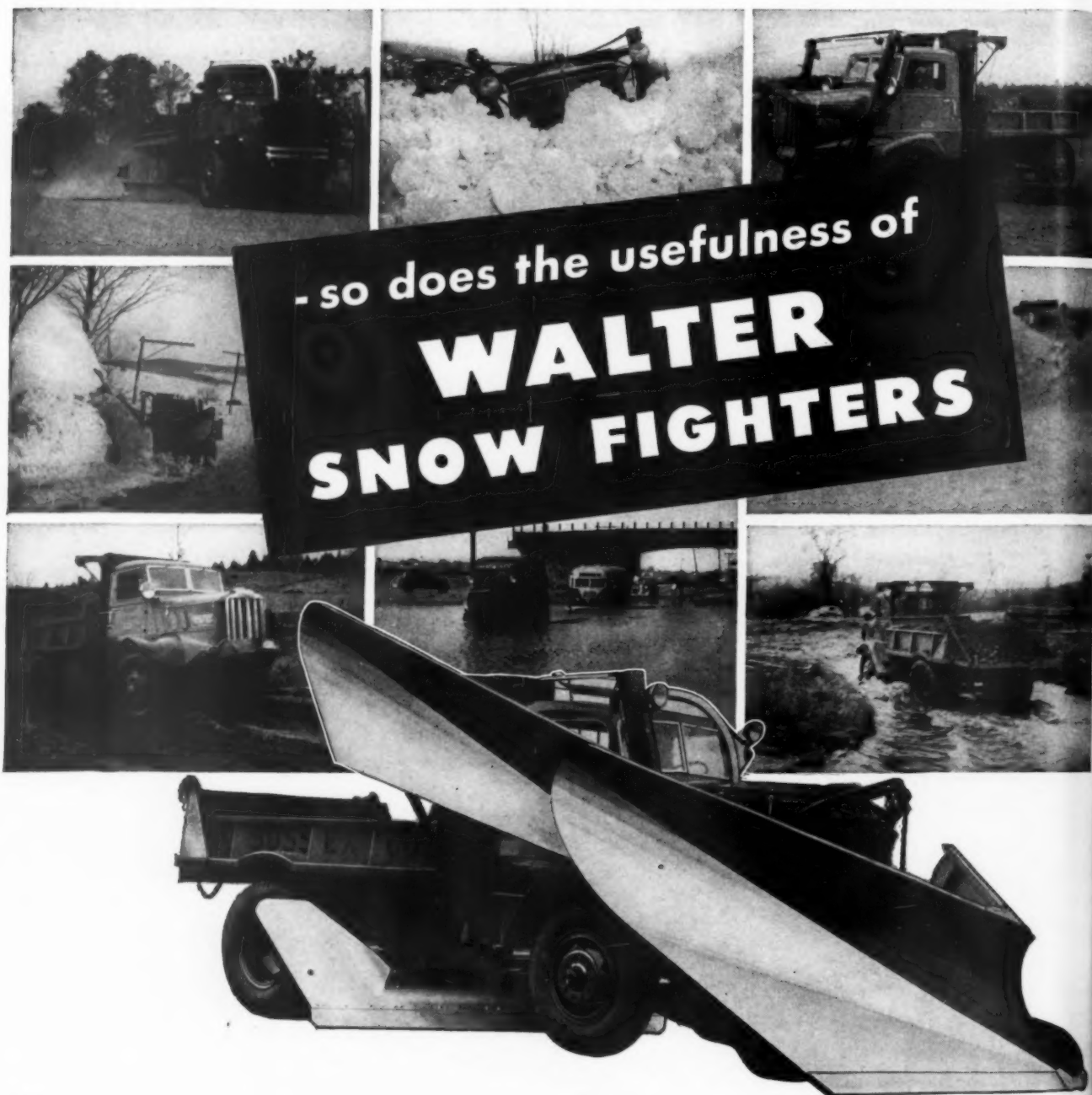
BUILDERS OF ROAD MACHINERY

**Austin Western**  
SINCE 1859



Y...  
g—good  
in speed—  
hat's the  
an all-  
r Grader  
e traction  
ust offset  
or drawn  
front end,  
wheels to  
is needed  
you want  
where the  
t distrib-  
blade and  
T" drives  
t, BUT-  
drive and  
ds can be  
with live  
ced team,  
the front  
Wherever  
slopes, in  
mainte-  
u'll find  
M". The  
all-wheel  
any task  
MACHIN-  
Distribu-  
address

# Bad Weather Goes 'Round the Calendar



**W**HEN the blizzards stop, your Walter Snow Fighters are ready for their next important jobs . . . battling spring floods and washouts, summer cloudbursts and fall gales that cripple traffic and damage highways.

The exclusive Walter 4-Point Positive Drive provides the unfailing four-wheel power-plus-traction that is so indispensable in ramming snowdrifts — freeing pavements of hard-packed snow and ice — scraping dirt and gravel roads after rainstorms — or pulling heavy loads through snow, mud, sand, ruts or up stiff

grades, without bogging down, slipping or stalling.

The basis of Walter 4-Point Positive Drive is its three patented lock differentials which automatically proportion the power to each wheel according to its traction at any instant. Suspended Double Reduction Drive provides greater gear capacity, reserve power, higher ground clearance and less unsprung weight. These, plus many other engineering features, make Walter Snow Fighters a sound investment for every-day and emergency service. Write for full details.

**WALTER MOTOR TRUCK CO. • 1001-19 IRVING AVE., RIDGEWOOD, QUEENS, L. I., N. Y.**  
ROADS AND STREETS, March, 1943



dar

IN CONSTANT SERVICE SINCE '37  
MOVED FIVE TIMES . . . . . AND

*still trouble free!*

This Blaw-Knox  
Portable Bulk Cement  
Plant has been erected  
and dismantled five  
times, on as many  
projects



Guy Hamm, Plant Superintendent for Thomas McQueen, Forest Park, Illinois, engineers and contractors, has poured hundreds of thousands of square yards of concrete paving with this bulk cement plant. He says—"In five separate locations we've used this plant with convenience, speed, and maximum dependability!"

*Trouble-free because...*

CEMENT GATE VALVES are made of machined castings, will not leak or jam.

WEIGHING SCALES are of the precision type. They show when the batcher is full or empty.

BIN SLOPES are steep and smooth for fast flow of the cement.

STURDY CONSTRUCTION permits repeated dismantling and re-erection.

BEST QUALITY conveyors and power drives.

Ask your nearest Blaw-Knox Distributor to tell you about this remarkable Bulk Cement Plant.

**BLAW-KNOX DIVISION**  
of Blaw-Knox Company

2003 FARMERS BANK BUILDING  
PITTSBURGH, PA.

NEW YORK CHICAGO PHILADELPHIA  
BIRMINGHAM WASHINGTON

REPRESENTATIVES IN PRINCIPAL CITIES

NO PIT REQUIRED  
Elevator rests on ground level

installing.  
ts three  
ly pro-  
to its  
duction  
power,  
weight.  
, make  
every-  
details.

# BLAW-KNOX BULK CEMENT PLANTS

N. Y.

CONCRETE SPREADERS • ROAD FORMS • TRUCK MIXERS • CONCRETE FINISHING MACHINES  
CLAMSHELL BUCKETS • BINS AND BATCHERS • CONCRETE BUCKETS • STEEL STREET FORMS  
BULK CEMENT PLANTS • CENTRAL MIXING PLANTS • TRUCK TURNABLES • TAMPING ROLLERS

For highways built with an eye to the future . . .

*Specify* **WIRE FABRIC  
REINFORCED  
CONCRETE**



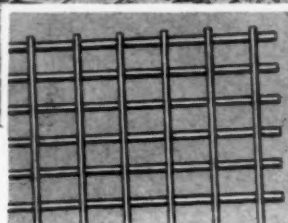
**C**ONCRETE pavement slabs reinforced with the required amount of Wire Fabric, properly designed and constructed with adequate joints, will stand a practically unlimited number of stress repetitions without concrete failure or fatigue. The use of Wire Fabric is sound engineering. That's why reinforced concrete has been so widely accepted for construction of so many long-lasting roads and streets.

America will need many new highways in the period ahead. And to make them durable, with low maintenance costs, make a note to specify Wire Fabric reinforced concrete pavements.

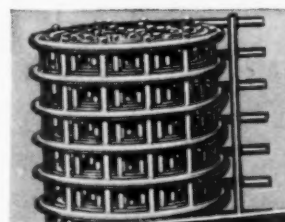
## AMERICAN STEEL & WIRE COMPANY

*Cleveland, Chicago and New York*

*Columbia Steel Company, San Francisco, Pacific Coast Distributors  
United States Steel Export Company, New York*



IN SHEETS . . . OR IN ROLLS



**AMERICAN  
ELECTRIC WELDED  
WIRE FABRIC**

# UNITED STATES STEEL



**WOOD ROADMIXER**

...CONSISTENTLY  
**DELIVERS 250 TONS PER HOUR**  
**OF HIGHEST QUALITY MIXED**  
**AGGREGATES**



## **—At less than blade-mix costs!**

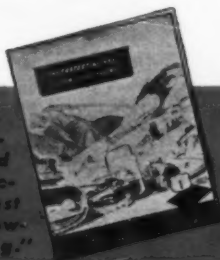
Here is speed and *quality* in pavement construction at lowest cost! Wood Roadmixer, by employing the traveling plant method of pavement construction, eliminates excessive, costly and complicated equipment.

Two men can operate the Roadmixer, tractor and binder supply truck. This streamlined operation produces 250 tons per hour, or

2,000 tons per 8-hour day of top quality paving. And the cost is far less than time-consuming, inaccurate blading—and other ordinary methods of pavement construction.

Choose your own paving job, under the toughest possible conditions, and use a Wood Roadmixer. You'll get a better job, faster and at less cost than by any other method of pavement construction you have ever used.

Write for detailed and illustrated Wood Roadmixer bulletin, "The Fastest Method of Low-Cost Paving."



# **WOOD ROADMIXER**

Wood Manufacturing Co. • 816 West 5th St., Los Angeles, California





## Magdraulic Electric Brakes

*Introduce a  
super-powered  
"Electric  
Squeeze"  
for heavy loads*



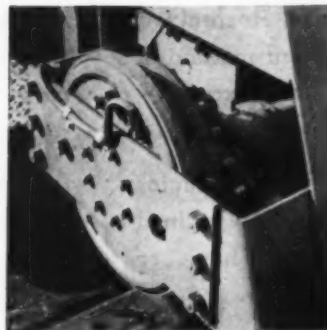
The tremendous war job being handled by heavy earth-moving, digging, filling and scraping equipment has also directed new interests in improvements for these machines.

The MAGDRAULIC Electric Brake, developing such amazing torque within itself, is being singled out for the job of bettering brake performance.

The Haiss Model 77 Loader, with MAGDRAULICS as special equipment, is one of the most recent examples of the switch to electric braking. In operation, it controls and maneuvers with a great deal less effort, and in less time, too.

We invite inquiries from equipment designers and builders who are interested in better braking. MAGDRAULIC Electric Brakes are made in several sizes and can be easily adapted. Why not consult with our engineers before freezing new designs. Or, you may like to begin planning for post-war changes. New Data Book available on request. Write to

EMPIRE ELECTRIC BRAKE CO., NEWARK, N. J.



THE NEW MAGDRAULIC Electric Brake is compact, self-contained and streamlined. Electric force for braking flows in slightly exposed cable. Both right and left hand brake can be independently set by controllers.



THE NEW MAGDRAULIC Electric Brake is set by electric current, controlled by right and left hand controllers shown above. The operating levers can also be handled by operator from same position.

# Pays You

## TO HAVE SERVICING HANDLED IN DEALER'S SHOP!

Common sense tells you, you will get superior workmanship if your equipment servicing is handled under ideal conditions. That is why more and more equipment owners are hauling their units into Allis-Chalmers dealer shops for repairs, rebuilds, replacements. They are taking care of their hard-to-replace machinery...the best way...the shop way! Dealer mechanics, working in comfort, with proper illumination, the right-type tools and genuine parts...plus the expert help and advice of the shop foreman, can speedily turn out better jobs. Delicate Diesel parts are handled more carefully, too, in clean surroundings!

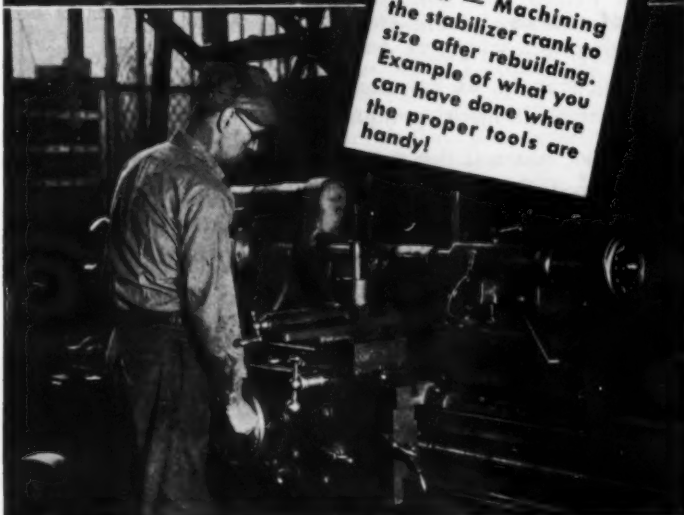
Next time your outfits need servicing...try this better, faster, shop plan. It will repay you many times over! Your machines will be back to work about as soon...will be ready to put in many extra hours of work with less downtime. Call your Allis-Chalmers dealer. Make arrangements to haul 'em in!



Ample, comfortable service quarters, with all tools and parts handy, enable Allis-Chalmers factory-trained mechanics to quickly turn out highest-grade jobs.



Above — Rebuilding a stabilizer crank by welding.



Below — Machining the stabilizer crank to size after rebuilding. Example of what you can have done where the proper tools are handy!

**ALLIS-CHALMERS**  
TRACTOR DIVISION — MILWAUKEE, WIS., U. S. A.



To Allis-Chalmers...the Army-Navy "E", first such award for tractor production.



## We have two reasons to be proud of this Flag

**First, of course,** we are proud of the Army-Navy "E" flag because it is an award to the 3,000 employees of our Richmond refinery. We have long known that their energy, devotion and skill merit the highest praise.

The other reason is that this flag is a harbinger of better days to come, when we will take pride in offering to industry the fruits of Richmond's tremendous war effort.

Today we can only hint at the giant strides our petroleum research and production have made. We cannot publish the specifications of a host of new products, nor the story of how old products have been sensationally improved. We cannot describe the system by which these products are distributed on a world-wide scale.

But we can promise you that, when these facts become known, they will open new horizons for American businessmen and technicians in many fields. They will prove once again that "know-how" can turn yesterday's impossibilities into tomorrow's accomplishments.

In the meantime, the Richmond refinery and all of Standard of California are living up to the "E" flag, helping bring the inevitable victory nearer.

**STANDARD OIL COMPANY OF CALIFORNIA**  
ROADS AND STREETS, March, 1943



### **RPM DELO IS USED IN U. S. NAVY DIESELS**

First used in submarines, RPM DELO performed so well that it is now also used to lubricate high-speed Diesels in the Navy's mine sweepers, sub chasers, landing barges, patrol boats and ocean-going tugs. In all these vessels it is licking some of the toughest lubricating problems in the world. RPM DELO is typical of Standard's development of petroleum products for war.



RPM DELO is marketed under the following names:

RPM DELO • Caltex RPM DELO • Kyso RPM DELO  
Signal RPM DELO • Imperial-RPM DELO • Sohio RPM DELO  
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity



To American Earthmovers . . .



# HERE'S HELP for Your Tractor Operators

## Take Advantage of These 5 Helpful LeTourneau Services on Equipment Operation and Repair

To help you get more work done with your present LeTourneau road-building equipment . . . and make it last longer . . . LeTourneau offers you the following aids to proper equipment operation and maintenance:

### Operator Instruction Books



LeTourneau operator instruction books contain completely - illustrated, easy-to-understand information for both operating and servicing. For example, the Carryall Scraper book, in addition to routine operating procedures and adjustments

gives your men practical earthmoving suggestions for opening cuts and fills, maintaining slopes, reducing cycle time, pusher loading, tandem operation, handling of special materials and situations. Power Units, Dozers, Rooters, Tournapulls, Cranes, Sheep's Foot Rollers, etc., are also covered in separate books—available to your men free.

### More Operating Ideas

The "Co-Operator-Methods," a factual, 16-page magazine is written by men who

know earthmoving methods and equipment maintenance from years of actual experience. Shows your operators how to get more work out of your equipment through efficient job-proved methods; tells how to make your equipment last longer through a series of articles on equipment repair, service, lubrication, cable care, tires, etc. 45,000 monthly circulation. Free to you.



### How to Make Your Construction Tires Last Longer



Fact - packed bulletin, "Stretch Your Tires," prepared especially by LeTourneau for servicemen, opera-

tors and mechanics who want to know more about: Recommended Carryall tire pressures under all working conditions • Tire-conserving operating hints • Proper tire upkeep and repair • Haul road maintenance • Recommended tire tools, accessories, etc.

### Quick Guide to Lubrication of LeTourneau Equipment



Big chart tells you what points need lubrication, how often to lubricate and what lubricants to use

to keep your LeTourneau equipment operating at top efficiency.

### Complete Dealer Service

A recent survey of 101 LeTourneau-"Caterpillar" dealers in U. S. and Canada showed an average of 12 servicemen per dealer; 80% have portable welding outfits to make prompt repairs in the field. All but two have shop welding outfits; 101 employ skilled welders. They have a consistently good reputation for quick parts delivery. All these services—plus help on job planning—you get in one time-saving stop at your local LeTourneau-"Caterpillar" dealer. He's enlisted in your service for the duration. Make him your Victory Construction Headquarters.

(Below) Veteran 8 yd. LeTourneau Carryall with new "Caterpillar" D7 Tractor extending Oakland, Calif., streets. Proper operation and maintenance keeps these older rigs working today when new equipment is difficult to get.



Manufacturers of DOZERS, CARRYALL, SCRAPERS, POWER CONTROL UNITS, ROOTERS, SHEEP'S FOOT ROLLERS, TOURNAPULLS, TOURNAROPS, TOURNATHAILERS, TOURNAWELD, TRACTOR CRANES

U.S. Pat. Off.

# LETOURNEAU

PEORIA, ILLINOIS STOKES, CALIFORNIA

Dept. RS3, Peoria, Ill.

Gentlemen: Please send me:

\_\_\_\_\_ copies of the Co-Operator  
regularly.  
\_\_\_\_\_ copies "Stretch Your Tires"  
bulletin.

\_\_\_\_\_ copies "Quick Lubrication  
Guide."

Also send me the following Instruction  
Books:

Name .....

Company .....

Position .....

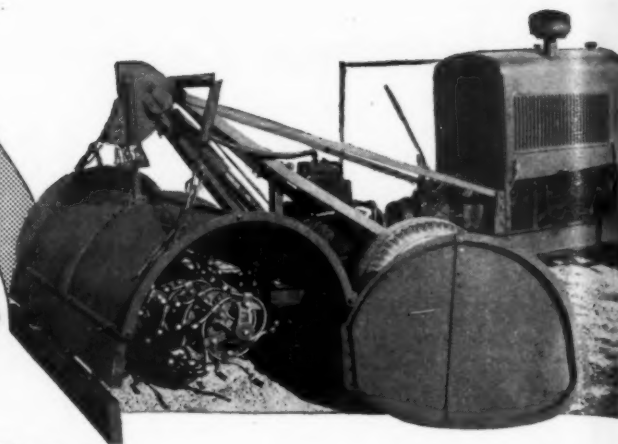
Address .....

*For building*  
**BETTER HIGHWAYS**  
*to the* **SKYWAYS**

# ROTOTILLER

TRADE MARK REG. U.S. PAT. OFF

## ROADMAKER



**SOIL STABILIZATION** is speeding military operations wherever our armed forces are or go. Using local materials or any others available, highways, landing strips and airfields can be built or repaired faster, better, more economically.

ROTOTILLER Roadmaker is the pioneer "3-in-1 Rotary Action Machine" especially designed and built for soil-cement and soil stabilization work. The "3-in-1 Rotary Action" assures more accurate control in both wet and dry mixing operations as well as more thorough pulverization of materials. The fast-revolving, self-sharpening tines thoroughly mill the earth from top to bottom to a depth of 12 to 18 inches *in one operation*. GET THE FACTS on this 1943 job-tested ROTOTILLER Roadmaker. Write for descriptive literature.

**ROTOTILLER, Inc.**  
 Dept. P TROY, N. Y.



ABOVE: Mixing clay and sand to depth of 12 to 14 inches on experimental project for U. S. Naval Construction Battalions (Seabees). Note fine pulverization and uniformity of mix.

LEFT: Scarifying to rebuild old road.

RIGHT: ROTOTILLER Roadmaker takes sharp turns with safety without taking tines from ground or stopping tillage unit.



### 7 STAR FEATURES

1. Improved, self-sharpening, single unit spring-tines.
2. 4-speed transmission permits use for scarifying as well as mixing.
3. Flexible tilling unit gives fast, easy operation; sharp turns with safety.
4. Weight of tilling unit variable to suit conditions; lessens wear.
5. Depth of operation regulated to within one-half inch.
6. Powerful 6-cylinder Chrysler motor operates economically on 1 to 2½ gallons of gasoline per hour, depending on conditions.
7. Strong, dependable ROTOTILLER Roadmaker cuts 6 ft. wide, 12 to 18 inches deep, with complete ROTOTILLAGE across entire width of cut — no untilled areas.

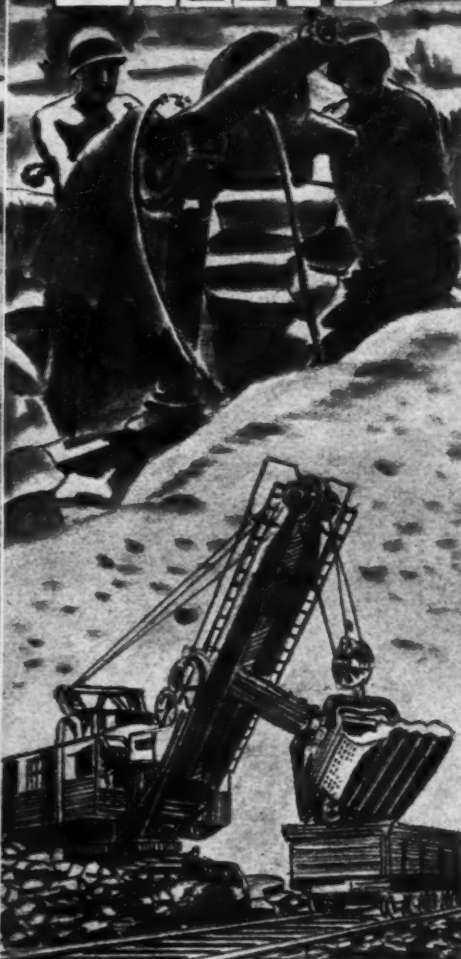
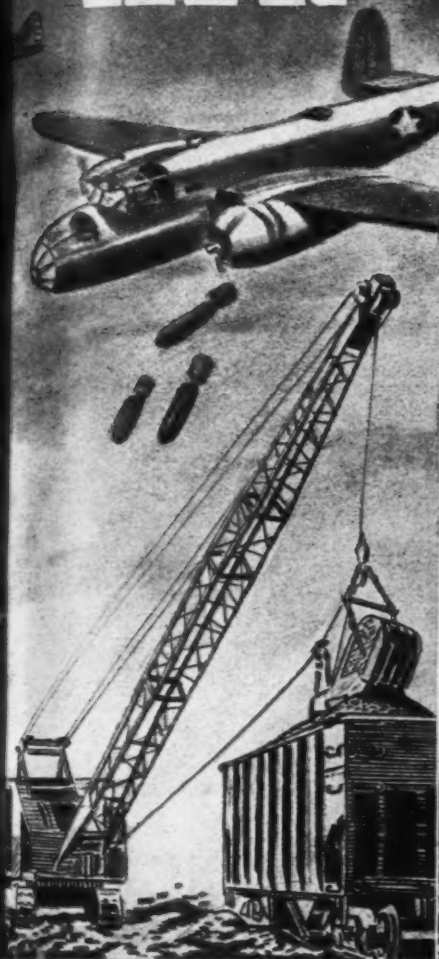
Post war plans undoubtedly will call for thousands of miles of soil-cement and oil stabilized secondary roads. Returning soldiers will find economic security in this work. Then, as now, ROTOTILLER Roadmaker will serve faithfully and well.



# AIR

# LAND

# SEA



## Everywhere MARIONS Are Setting The Stage for Victory!

In open pit mines, digging raw materials for fighting tools . . . in quarries, gravel pits and on sand piles . . . on vast Army, Navy and Maritime construction projects . . . in shipbuilding yards . . . along cargo loading docks, MARIONS of every description are at work putting new confidence into the United Nations with every swing of the boom . . . bringing defeat ever nearer to the enemy with every load it delivers. Yes, the powerful influence MARION machines are wielding in this war is helping to write a brilliant chapter of production and material handling accomplishments that will be recognized in history as one of the forerunners to Victory.

THE MARION STEAM SHOVEL CO., Marion, O., U. S. A.



# MARION

SHOVELS • DRAGLINES • CLAMHELLS  
CRANES • PORTAL CRANES • WALKERS

WORKING FOR VICTORY: DIGGING — Coal • Magnesium  
Iron Ore • Copper Ore • Bauxite • Manganese • Nickel  
Molybdenum • Sand & Gravel • Clay

MATERIAL HANDLING — Shipbuilding and Cargo Loading

BUILDING — Airports, Ordnance Plants, Arsenals, Army  
Camps, Marine Bases, etc.





## QUIZ on application of *soil-cement* for light traffic war pavements

### **When should soil-cement be considered?**

**Answer:** The field of use of soil-cement includes low first-cost auxiliary and secondary airport surfaces, plane parking areas and taxiways, light-traffic military roads and streets, parking areas for army trucks and war workers' cars, road shoulders and widening.

### **What types of soil can be processed?**

**Answer:** Soils on the site are usually satisfactory. Old gravel or stone roads containing 50% or more soil also can be successfully treated.

### **What engineering supervision is required?**

**Answer:** Job control by a full engineering field force giving careful attention to details is essential. Simple, scientific procedures in both laboratory and field assure uniform results at any job speed.

### **What rate of construction can be planned?**

**Answer:** Usually 5,000 to 10,000 sq.yd. daily; 10,000 to 20,000 frequently obtained; 350,000 sq.yd. in 19 working days reported for one job; 35,000 sq.yd. in peak day of 18¾ hours on another. Rate of production may depend on ability to put competent engineers on the job, rather than on work crews and equipment. Speed is result of efficient organization of simple equipment and small crews of ordinary labor.

### **What material must be transported?**

**Answer:** Generally just the cement and water. Soil-cement, being approximately 85 to 90% soil, requires little trucking or rail haul of materials. When borrow soils are occasionally used, short truck haul is common.

Call on our engineers for design and construction assistance on your soil-cement war projects. Write for new laboratory handbook, "Soil-Cement Mixtures," mailed free in the U. S. or Canada.

## PORTLAND CEMENT ASSOCIATION

Dept. A3-28, 33 W. Grand Avenue, Chicago, Illinois

BUY WAR SAVINGS BONDS AND STAMPS



# Accurate BOOM CONTROL

## *Easy Pipe Spotting*

Koehring Cranes can handle and lay pipe efficiently and safely... because of the Koehring accurate boom control. War construction projects require speed and safety. Hoisting the load, raising the boom while swinging saves seconds with every operation. Every move is a second-saver in handling material... waste motion is reduced to a minimum. All these time-saving advantages of Koehring mean greater speed on the job... for greater production per hour.

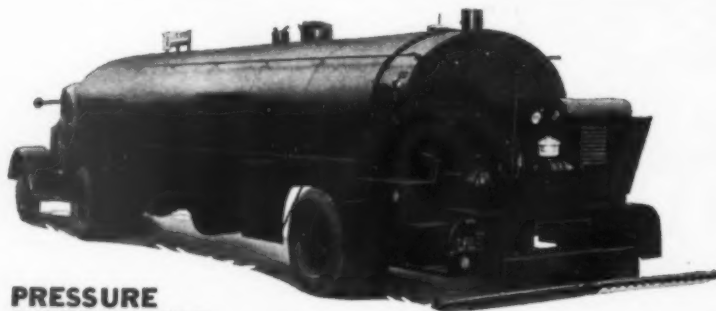
**KOEHRING CO., Milwaukee, Wis.**



## HEAVY-DUTY CONSTRUCTION EQUIPMENT

# AFTER VICTORY

## WHAT ARE YOUR PLANS?



**PRESSURE  
DISTRIBUTOR**



**ROAD BROOM**



**SUPPLY TANK**



**TANK CAR HEATER**

Unconditional Surrender must come first! But while we are all working to the end, let's think of the future. Let's do some post-war planning, too.

Plan so you'll be ready to put our vital Highway System back into tip-top shape. Plan the equipment you'll need to do the job, the most efficient way. Plan to purchase Littleford Equipment to do modern Highway Building and Maintenance jobs.

The "Spray Master" Pressure Distributor applies bituminous materials faster, more efficiently, and at lower cost.

The "Tankar" Heater will heat tank cars of materials faster than any similar unit, produces steam in 2 minutes' time.

The "Supply Tank" will transport the materials from the tank car to the Distributor on the job; frameless construction gives better load distribution.

"Road Brooms" either power driven or traction driven sweep in either direction. They sweep highways before applying materials.

Stick to winning the war, but think of Littleford Black Top Road Equipment for making a better world for the future.

**BUY WAR BONDS AND STAMPS**



# LITTLEFORD

**LITTLEFORD BROS., INC.**

454 E. Pearl St.

Cincinnati, Ohio



*a jungle gets a  
"Shave!"*



### News from "Down Under"

War Correspondent: "This isn't like the Spanish-American War, is it?"

Army Engineer: "Hell, no! Malaria, typhoid and dengue were our worst enemies then, I believe."

W.C.: "This war seems more than a matter of fighters and guns. I notice a lot of construction machinery in use in this neck of the woods."

A.E.: "Yes, this war tops all others when it comes to the use of equipment such as you see along highways and around building projects all over the States in peace-time. Take those bulldozers over there—it'd be tough goin' without those babies—not only here, but on all our fronts."

W.C.: "I suppose it would be a tough job carving landing fields and roads out of that dense tropical growth without those rigs?"

A.E.: "Tough job? It would be practically impossible! You see, those dozers bowl over trees, tear out matted bougainvillea, grub out roots that would quickly start growing again if you didn't eradicate them, fill up the holes that are left and level smooth as a pool table, ready for surfacing—do it single-handed."

W.C.: "How do the Nips do it?"

A.E.: "Mainly with 'rice burners,' using picks and shovels. These bulldozers are our ace in the hole. When Nip captives see how we do it, they lose their superiority complex, but pronto."

(Based on a news story, "Yank Engineers 'Lift' Faces of South Sea Isles," by E. R. Noderer, Chicago Tribune ace war correspondent.

## Baker Hydraulic Bulldozers Do the "Barbering"

Contractors and road builders who have piloted Bakers through piney woods and forests would get a kick out of the way cat-skinners in uniform are using them to clear patches of jungles that are as tangled as spaghetti, sloshing through mangrove swamps that were yesterday thought impenetrable.

When the peace treaties are signed and the big post-war rebuilding job gets underway, ask the vets who saw the amazing job Bakers did—ask the boys who ran them what they think of direct hydraulic lift and full down pressure on the blade—of Baker's fast, positive action and ease of maintenance. Then, you'll want Bakers, too!

### THE BAKER MFG. CO.

"If it concerns Victory, it concerns us"

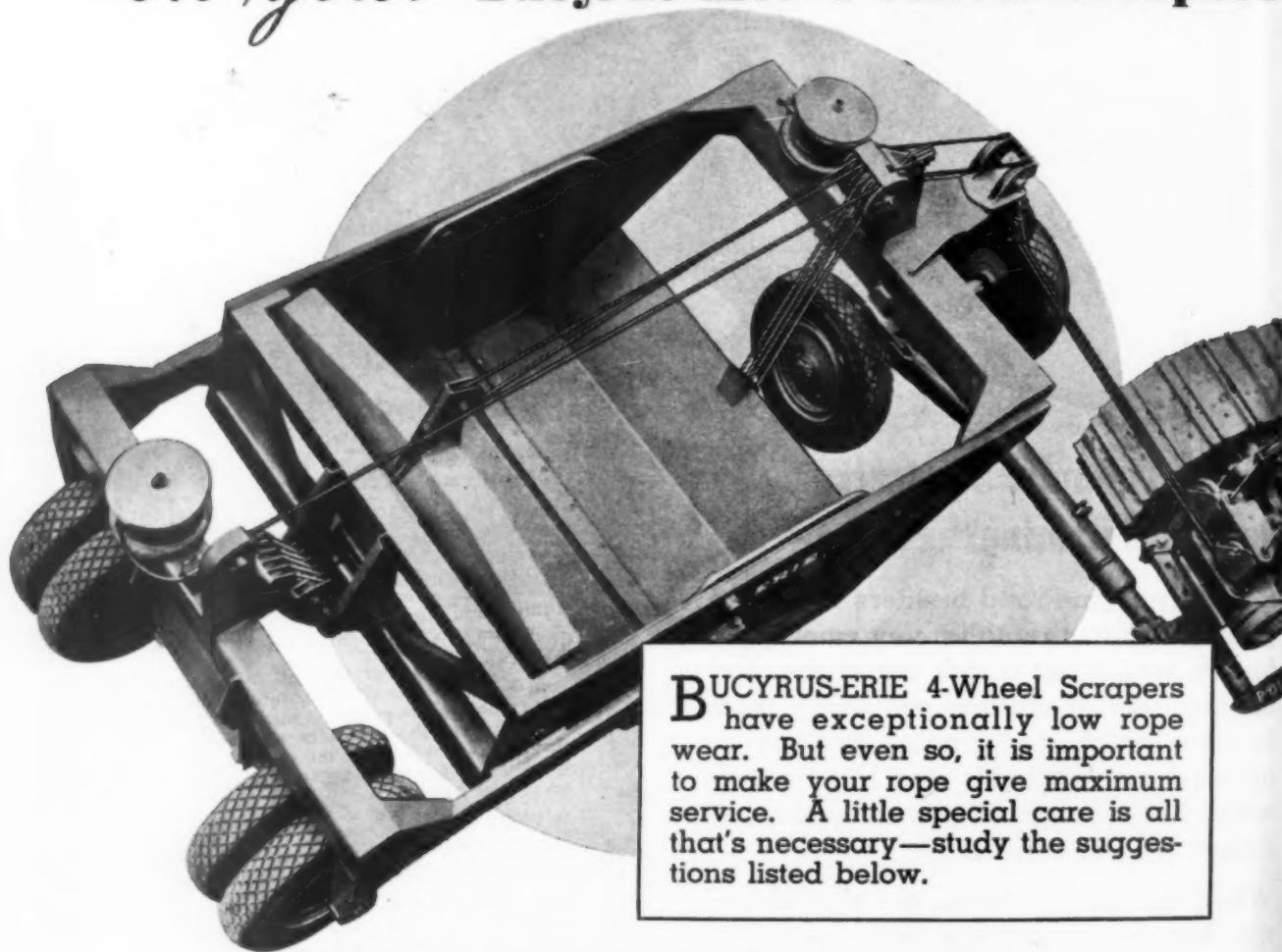
506 Stanford Avenue  
Springfield, Illinois

# BAKER

*The Modern Tractor Equipment Line*  
for  
EARTH MOVING  
LEVELING AND GRADE BUILDING  
SNOW REMOVAL  
ROAD MAINTENANCE

ROADS AND STREETS, March, 1943

It's *Easy* To  
**PROLONG ROPE LIFE**  
*on your* Bucyrus-Erie 4-Wheel Scrapers



**B**UCYRUS-ERIE 4-Wheel Scrapers have exceptionally low rope wear. But even so, it is important to make your rope give maximum service. A little special care is all that's necessary—study the suggestions listed below.

### FOLLOW THESE SIMPLE RULES

- |  |  |
|--|--|
| <p>★ Check all the cable leads regularly to see that ropes are properly aligned to prevent any undue rope wear.</p>  | <p>★ If a sheave-stand becomes bent be sure to straighten it immediately, before the off-lead damages or cuts the cable.</p>                               |
| <p>★ Disassemble and clean the sheaves regularly so as to keep them working smoothly and prolong their life.</p>   | <p>★ Save cable by avoiding unnecessary stress. Do not travel with ejector, apron or bowl hoisted to extreme height.</p>                                   |
| <p>★ Replace sheaves when they become worn to a point where they may damage rope. Bucyrus-Erie sheaves are identical and interchangeable on most models.</p> | <p>★ Your International TracTracTor Distributor is equipped to do a service job as never before to help you prolong the useful life of your equipment.</p> |

**BUCYRUS  
 ERIE**  
 TRACTOR EQUIPMENT

SEE YOUR  
**INTERNATIONAL TracTracTor**  
 DISTRIBUTOR



# "Indispensable"—

says Indianapolis Power and Light Company

● Many reports of the capabilities and advantages of Marmon-Herrington *All-Wheel-Drive* converted Ford trucks have come from military operations overseas. With Montgomery's British Eighth Army in Africa, in Australia, New Zealand and the Solomons, and in other vital areas, the superior tractive power of all wheels driving has been of tremendous value.

Here, at home, too, these vehicles, with their ability to operate through deep mud, sand and brush are equally appreciated. The unit shown has saved thousands of man hours for the war effort in digging over 10,000 pole holes in less than four years. . . . Take best care of the Marmon-Herringtons you have, and let War Bond purchases speed the day when you can buy more.



MARMON-HERRINGTON

*All-Wheel-Drive*

MARMON-HERRINGTON CO., Inc., INDIANAPOLIS, INDIANA

Cable Address: MARTON



# 415,000 TONS of ROCK for VICTORY

**LESS THAN  
SEVEN MONTHS OUTPUT  
for the  
KASER CONSTRUCTION CO.  
ADEL • IOWA**

Output like this means something to you for the future! 415,000 tons of stabilized base, concrete aggregate and sub-base materials (all for vital defense projects) is a real indication of what Cedarapids plants are doing under pressure.

This is the output of one Cedarapids plant owned by the Kaser Construction Company of Adell, Iowa, on their Lecompton, Kan., Eudora, Kan., and Pawnee, Okla., jobs which cover a period of less than seven months time.

Output like this can only be accomplished with trouble-free service day after day—the kind of service that you are going to require after the "Duration".

It doesn't matter what your aggregate reduction and producing problem is—whether it is small or large—Cedarapids plants can be engineered for any combination of final size or production. Iowa can meet your future plans whether it is for crushers, screens, bins, asphalt plants, driers, or portable or stationary plant equipment. Now is the time to familiarize yourself with Cedarapids equipment. Come to headquarters for aggregate producing equipment.

**IOWA MANUFACTURING CO.**  
Cedar Rapids • Iowa

## Cedarapids

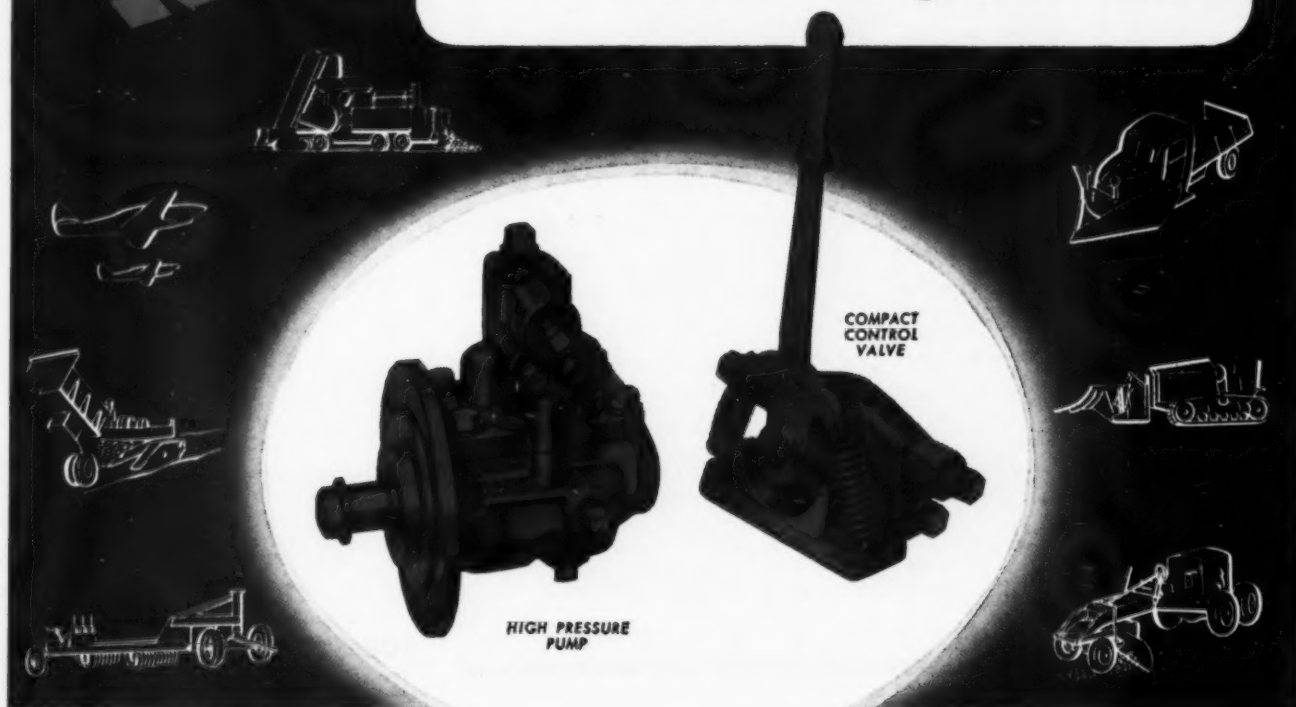
**BUILT  
by  
IOWA**

*Production for Victory*

**FOR VICTORY  
BUY  
UNITED  
STATES  
SAVINGS  
BONDS  
AND STAMPS**

ON SALE AT YOUR POST OFFICE OR BANK

## ... New Power Operated POWER-PACKER Pump and Valve



### Blackhawk High Pressure Hand and Power Controls Are Used on Every Type of Equipment Where Pressure Must Be Applied

Blackhawk Hydraulic Controls have long been famous for their remarkable efficiency. The country's leading road-machine manufacturers have put them to every test — have proved their advantages. That's why most of them have standardized on Power-Packers.

Now the newly developed units, shown above, increase the already great range of Power-Packer utility. Whether your needs are for power or hand control, Blackhawk Power-Packer HYDRAULIC Units give you dependable lifting power for speedy ac-

tion, efficiency, ease of control and accuracy. Blackhawk Power-Packer hand pumps develop pressures up to 5,000 lbs. per square inch. Blackhawk power pumps are interchangeable with the hand pumps in almost every case since they deliver 4,000 lbs. per square inch. Thus rams, hose lines and control valves can be made smaller — friction losses are greatly reduced, conserving power, thus making units more efficient. For complete list of advantages, write your equipment manufacturer—or write us direct.

A Product of BLACKHAWK MFG. CO., Dept. RS, Milwaukee, Wisconsin

**BLACKHAWK**  
WORLD'S LARGEST MANUFACTURER OF  
*Hydraulic Equipment*



Do not gamble with light and safety. DIETZ LANTERNS give dependable light with safety—for over a century.



ALSO  
DIETZ

ROAD  
TORCHES



## Replace DANGER with SAFETY

Place DIETZ LANTERNS on guard for every emergency use. They faithfully guide the way, night after night, without diminishment of light.

DIETZ LANTERNS will not fail or falter as long as a drop of oil remains to burn. Many models will give light and safety for an entire weekend with plenty of kerosene left to spare.

Keep your DIETZ LANTERNS in good service—ready for use the moment needed.

**R.E. DIETZ COMPANY**  
1840 NEW YORK 1943

Output distributed through wholesalers exclusively.



He's somewhere in Baltimore or Washington, keeping the business appointments he made by telephone from his room at the Lord Baltimore. He'll be back this evening because he'll be in this territory for several days; because he finds the Lord Baltimore convenient to Baltimore's war industries and official Washington and because the Lord Baltimore is the hotel that suits his rather discriminating taste.

Thinking it over—he could be you!

**The LORD BALTIMORE HOTEL**

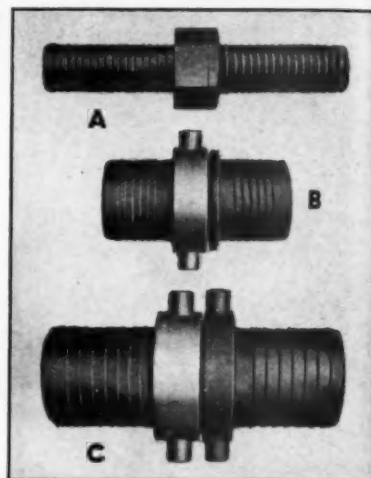
BALTIMORE • MARYLAND

700 rooms—each with radio, tub and shower

We want you to have the best room available. Wire a reservation and we'll see that you get it.



## "KING" All-Malleable Iron SHANK COUPLINGS



### FOR SUCTION and WATER HOSE

The couplings described below were formerly made in all brass, or part brass. Due to the critical shortage of this material, they are now made entirely of malleable iron, and either black or synthetic enamel coated. They comprise a full range of styles and sizes for every service where shank couplings can be used to advantage.

### "KING" SHANK COUPLINGS . . .

"KING" Shank Couplings give long dependable service, with maximum convenience in connecting, disconnecting and resetting. Shanks have deep, clean corrugations. Sturdy pin-lug swivel nuts are sufficiently recessed to hold washer in place when hose is disconnected.

**HEAVY PATTERN (C)** has pin-lugs on both male and female sections. Shanks have ample length to accommodate two clamps.

**REGULAR PATTERN (B)** is of adequate weight for smaller sizes of suction and water hose. Pin-lugs on female section only.

**COMMON SHANK COUPLING.** (Not illustrated). For water hose in smaller sizes. Has swivel nut on female section. Available in sizes up to 1½".

**"KING" LONG SHANK COUPLINGS. (A)** A sturdy, durable coupling with shanks of ample length for two or more clamps. Female end has hex swivel nut, male end also has hex portion. Deep corrugations provide excellent gripping surface under clamp pressure. Carried in Stock by Manufacturers and Jobbers of Mechanical Rubber Goods

**DIXON**  
**VALVE & COUPLING CO.**

Main Office & Factory—Philadelphia, Pa.  
Branches:  
Chicago • Birmingham • Los Angeles • Houston



# Happy Landings



**Be sure OF AIRPORT RUNWAY AND HIGHWAY  
PAVING PERFECTION WITH *Keystone* PRODUCTS**



Keystone Products used in the typical paving job shown above give the contractor lower cost, easier handling and quicker delivery. They are waterproof and will never rust.

THERE'S a pleasant feeling for the pilot as he brings his high speed pursuit ship or bomber in for a landing. It's swell to know that the smoothly paved runway looming up so speedily will assure another "Happy Landing."

There is no cracking or humping of concrete when Keystone Asphalt Mastic Center Strip and Expansion Joints are used. The trapezoidal tongue-and-groove joint provides maximum load transmission. The modern improved paving method that saves thousands of tons of steel for its war job and does the paving job better.

WRITE FOR COMPLETE INFORMATION TODAY!  
JUST FILL IN AND MAIL THE COUPON

## Keystone

**ASPHALT PRODUCTS COMPANY**  
(A Division of the American-Marietta Company)  
43 E. OHIO STREET . . . CHICAGO



**KEYSTONE ASPHALT PRODUCTS COMPANY**  
43 E. Ohio Street, Chicago, Illinois

Please send me complete information on Keystone Mastic Board Center Strip.

Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_



## WAR JOBS WELL DONE MEAN LOWER FUTURE POWER COST

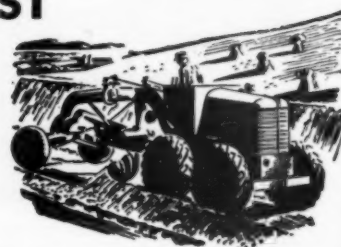
**S**CARCELY anything you can name fills so many different war jobs as the General Motors Diesel engine. In tanks, landing boats, patrol boats, trucks, tractors and auxiliaries—everywhere sturdy dependability is needed—they're supplying power for our fighting forces.

The result is that though plant facilities have mushroomed and production records are broken time and time again, everything we can make is hustled off to war.

But there is this important com-

pensation. These accelerated war demands are advancing GM Diesel production and technique years faster than could the demands of ordinary peacetime manufacture.

So we can look forward to lower-cost power and to new peacetime applications for these engines when the war is won—to broadened fields where this power will serve.



*Reconstruction and new construction are going to need plenty of this hard-hitting, easy-on-the-fuel power. With normal refinement and development speeded up by war, with production expanded, GM Diesels will be ready to serve in more fields and in more ways than ever.*



**ENGINES** . . . . . 15 to 250 H.P. DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.

**ENGINES** . . . . . 300 to 2000 H.P. CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

**LOCOMOTIVES** . . . . . ELECTRO-MOTIVE DIVISION, La Grange, Ill.

# *Smoother* BLACK TOP PAVEMENT

**FLEXIBLE**

**FAST**

**LEAVES  
PAVEMENT  
THAT  
ROLLS OUT  
"SMOOTH  
AS SILK"**

## **-with Continuous Course Correction!**

**C**ONTINUOUS Course Correction can be had only on the Adnun Black Top Paver. With each successive blacktop course, Continuous Course Correction reduces the irregularities caused by the inequalities of the subgrade. It is automatic, positive and does not depend on springs or manual controls of any kind. It is a foolproof assurance of smoother pavement.

Continuous Course Correction assures a smooth pavement with the minimum of rough grade preparation.

Initial compaction is provided by the design of the cutter bar without vibration and a dense course of the original mix results without bringing fats to the surface.

Here is a machine that gives true leveling without forms, accuracy of control and a course that rolls out smooth as silk. The future of road building is going to call for a lot of blacktop. Plan to know all about the Adnun. We will be glad to send literature on request to help you.

Built by  
the Builders  
of  
**MULTIFOOTE  
CONCRETE  
PAVERS**

# **ADNUN**

TRADE MARK REGISTERED

## **BLACK TOP PAVER**

**THE FOOTE COMPANY, INC.**  
**Nunda • New York**

*The World's Largest Exclusive Manufacturers  
of Concrete and Black Top Pavers*

**WITH CONTINUOUS COURSE CORRECTION**



# CLEAVER-BROOKS EQUIPMENT . . .



## ...ON THE FAR-FLUNG FRONTS OF GLOBAL WAR

In action with our fighting forces all over the world are "silent secret weapons" like these Cleaver-Brooks units . . . contributing to the health and welfare of our troops on far-flung fighting fronts.

Cleaver-Brooks' portable shower bath units—disinfecting, sterilizing, and water distilling equipment help our fighters to keep fit for action! Cleaver-Brooks portable bituminous boosters and tank car heaters permit miracles in speedy construction of airports, military roads, supply roads, and many other facilities vital to supremacy in modern warfare.

CLEAVER-BROOKS COMPANY • 5106 N. 33rd STREET • MILWAUKEE, WISCONSIN

On the home front, Cleaver-Brooks steam generators are providing low-cost steam for power and processing needs in hundreds of industrial and ordnance plants. All of this equipment is fired with the universal and ideal fuel—OIL! The multi-pass, down-draft heating principle with fuel-oil—first made famous in Cleaver-Brooks tank-car heaters, bituminous boosters, and steam generators—finds a vitally important application in these "silent secret weapons" of our military services.

Now manufactured for a nation at war, Cleaver-Brooks' equipment will resume its peacetime applications when Victory Day is here.

**CLEAVER-BROOKS COMPANY • MILWAUKEE, WISCONSIN**



C7 in action

## Just What You Need for PAVING BREAKING

**W**HATEVER your requirements, there is a Cleveland Paving Breaker exactly suited to the job. The 80 lb. C7 is the right tool for average work—two C7's run from a No. 85 compressor. For heavier work, use the C9; it is 2 lbs. heavier, but uses no more air. C9 is a slugger that licks the toughest, reinforced concrete. For light work, trimming, etc., try the C10, the little fellow with the big wallop. Three C10's run from a No. 85 compressor. Model C11 is the 58-pound machine with the long stroke and the heavy "slugging" blow—a favorite wherever used. Extremely economical as to air consumption.

Among accessories you can't beat "Cleveland" chisels, moils and miscellaneous paving breaker tools. Try the 14" narrow chisels, they cost no more than moils, but cut faster. Then specify tough, durable Cleveland "Veribest" air hose. Finally, connect it with Cleveland quick-acting Type "A" hose couplings, and you are all set for the toughest paving breaker job.

Ask for Bulletin 128 on Cleveland Paving Breakers

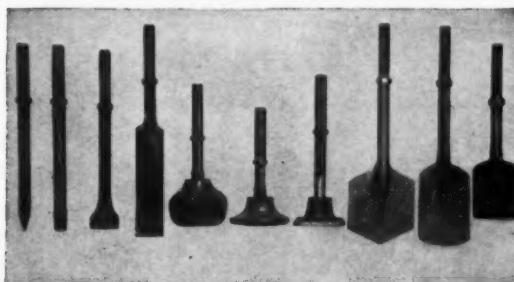
### BRANCH OFFICES

Birmingham, Ala.	Chicago, Ill.	Lexington, Ky.	Richmond, Va.
Berkeley, Calif.	Cincinnati, Ohio	Los Angeles, Calif.	Salt Lake City, Utah
Dallas, Texas	Detroit, Mich.	Milwaukee, Wis.	St. Louis, Mo.
Buffalo, N. Y.	El Paso, Texas	New York, N. Y.	Victor, Colo.
Butte, Mont.	Ironwood, Mich.	Philadelphia, Pa.	Wallace, Idaho
		Pittsburgh, Pa.	Washington, D. C.

### CANADIAN DISTRIBUTORS

Furves E. Ritchie & Son, Ltd., 658 Hornby Street, Vancouver, B. C.  
Whitehall Machine & Tools, Ltd., Galt, Ontario

### BUY U. S. WAR BONDS AND STAMPS



Moil Narrow Wide Digging Sheeting 7" Tamper 5" Tamper Clay Clay Asphalt  
Chisel Chisel Blade Driver Bar Bar Blade Spade Cutter



**THE CLEVELAND ROCK DRILL COMPANY**  
Subsidiary of The Cleveland Pneumatic Tool Company

CABLE ADDRESS: "ROCKDRILL"

CLEVELAND, OHIO

**LEADERS IN DRILLING EQUIPMENT**

ROADS AND STREETS, March, 1943

*"Lands like a Feather"...*



*with a* **60-TON JOLT**

The heavily-laden plane that lands so smoothly can mean lots of trouble for underground pipe. Even in a perfect "sit down" the impact equals the full weight of the plane. On less-than-perfect landings this force may be doubled or tripled. Yet drainage systems constructed of ARMCO Corrugated Metal Pipe take the punishment without flinching.

Flexible ARMCO Pipe (plain or perforated) has proved ability to resist crushing, cracking or disjoint-

ing under the impact and weight of heavy loads. This means freedom from failure even under shallow cover. You have continued assurance of a firm, dry field with uniform support for runways or direct wheel loads. Other advantages include long lengths; band couplers to assure strong joints; and ease of installation with unskilled labor.

Consider ARMCO Corrugated Metal Pipe when you are planning or building essential wartime airports. Ask your local ARMCO man to show you the Manual of Airport Drainage, or write us direct regarding specific problems. Write today to Armco Drainage Products Association, 185 Curtis St., Middletown, Ohio.

*Installing 800 feet of 66-inch Corrugated ARMCO Asbestos-Bonded Paved Pipe under runway at large bomber base.*



ROADS AND STREETS, March, 1943



**ARMCO**

**CORRUGATED PIPE**



War demands "guts"  
in shovels, too!



## Buckeye Clippers have plenty

From Alaska to Africa, Clipper full-revolving, convertible shovels proved that they have the "guts" to take it—that *Mevac* metered vacuum control gives faster, smoother, fuller loads whether it's 10° below zero or 110° above—that Clipper's dual right angle drive conserves power—that automatic swing brake, vacuum control dipper trip and other Clipper exclusive features *do* cut seconds off every operation in the working cycle.

After this global scrap is over, "guts" in equipment are going to count more than ever. Check the Clipper's "24 points of preference" and its war record to date and you'll want it on your construction jobs after the Axis has *surrendered unconditionally*.

**BUCKEYE TRACTION DITCHER CO.**  
Findlay, Ohio



# Buckeye✓

CONVERTIBLE SHOVELS, TRENCHERS AND BACKFILLERS, TRACTOR EQUIPMENT, R-B FINEGRADERS, ROAD WIDENERS AND SPREADERS



★  
**W**ars demand scrap.  
**I**nvest in War Bonds.  
**N**o laying down on jobs.

# FIGHTIN' PUNCH

*of a Flying Fortress*



American flying fortresses are effectively armored beyond comparison with other combat planes.

So too, Owen Buckets embody extra strength and re-enforcement at all points subject to particularly hard wear or excessive strains.

**The OWEN BUCKET Co.** Breakwater Ave.  
Cleveland, Ohio

Branches: New York, Philadelphia, Chicago, Berkeley, Cal.



# OWEN BUCKETS

A MOUTHFUL AT EVERY BITE

# SCOOP



3/8 yd. and 1/2 yd.  
Rubber-tire mounted  
Completely convertible

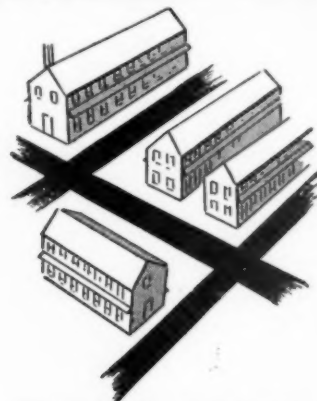
Scooping the field . . . beating schedules . . . operators do it daily with MICHIGAN Mobile Shovels! Truck mobility and Air Controls save time between jobs AND on-the-job. Get Bulletin S for details.

**MICHIGAN**  
POWER SHOVEL COMPANY  
BENTON HARBOR MICHIGAN

## ASPHALT

for

## CANTONMENT STREETS



Various low-cost types of Asphalt construction are ideally suited for cantonment streets where an improved all-weather surface is needed. Asphalt can be easily maintained for as long as it is needed, and can be abandoned at any time without a great investment loss.

Wherever Standard Oil Asphalt products are sold, there is an Asphalt Representative who can give you full information about these and other uses of Asphalt. Write

**STANDARD OIL COMPANY (Indiana)**  
910 SOUTH MICHIGAN AVENUE, CHICAGO

ARMY E NAVY

# "Straddledeck"

## TRAILERS

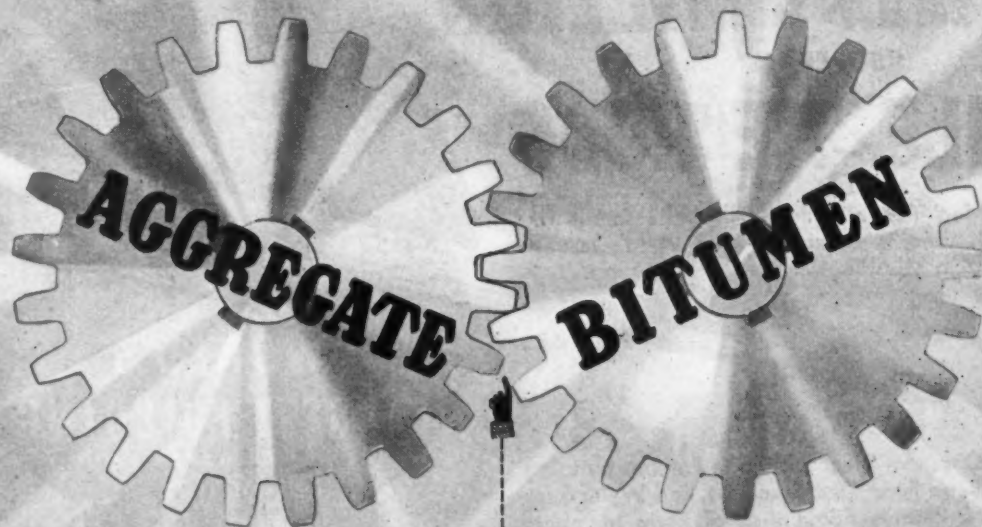


meet  
**SPECIAL NEEDS**

**ROGERS BROTHERS CORP.**  
ALBION, PENNA.

Bulky, cumbersome machinery, and of late heavy pieces of defense equipment must be moved from place to place. In some localities, where low headroom is encountered, this type of Rogers Trailer is used extensively. Large machines, with crawler treads "straddle" the girders thus lowering the overall height by several inches, a definite advantage also in handling many kinds of equipment.





# INTERLOCKED PROPORTIONING

**O**NLY in the Continuous Mixer is the ratio of aggregate to bitumen mechanically interlocked. The volumetric proportioning is calibrated by weight, the ratio set and locked, and the entire job run with interlocked proportioning.

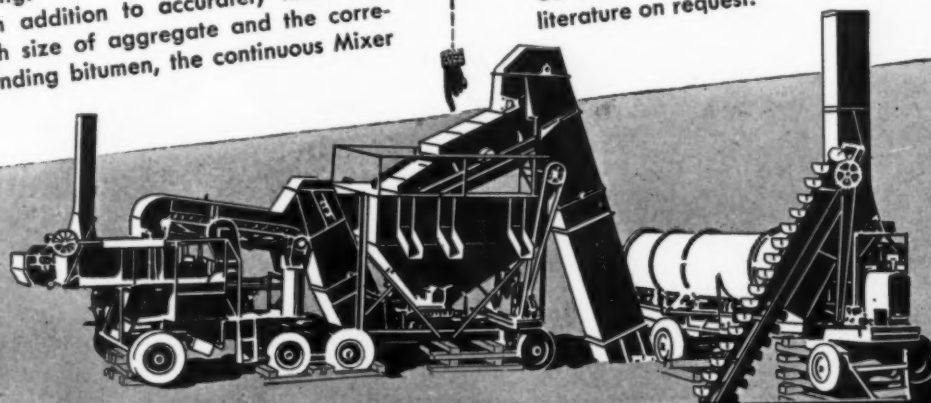
Even the most skillful mixer operators cannot maintain, hour after hour, the untiring precision of interlocked proportioning.

In addition to accurately measuring each size of aggregate and the corresponding bitumen, the continuous Mixer

constantly feeds the aggregate and bitumen into the pugmill in a small continuous stream—in practically a homogeneous distribution at the start of the mixing.

These advantages plus the unequalled economy of the Continuous Mixer make it truly tomorrow's Mixer today. Regardless of your present equipment, you should at least have a complete understanding of the basic principles of the Continuous Bituminous Mixer. Complete literature on request.

41-14



**BARBER**  **GREENE**  
AURORA ILLINOIS  
STANDARDIZED MATERIAL HANDLING MACHINES

ROADS AND STREETS, March, 1943



# More than a MILLION

"SUPER-HI"

## TENSILE TIE RODS ..

● More than a million "Super-Hi" Tensile Tie Rods used in construction of world's largest building at Arlington, Va.

● Conserve Steel and Form Lumber by using Williams Form Ties, Studlocks, and Waler Supports. Permits dismantling of Form Members instead of nailing and wrecking same. Triple the life of your Form Lumber and save 75% of Steel loss over ordinary Wire Ties.



Housing 40,000 workers, the War Department's Pentagon Building is the world's largest office structure. It also is uncommon because of its shape, concentric office rings, and ramps for pedestrian travel from floor to floor.

*Drawing by B. G. Seielstad for Popular Science*



# WILLIAMS FORM ENGINEERING CORP.

BOX 925 MADISON SQUARE STATION — GRAND RAPIDS, MICHIGAN

# ROADS AND STREETS

March, 1943, Vol. 86, No. 3

## Speed in Spite of 86 Rainy Days

**A** NORTH-CENTRALLY located airport job completed late in 1942 is notable for its construction progress in spite of phenomenally frequent rains, and for the difficult subgrade conditions corrected under intensive soils-laboratory guidance.

The field in question, which cannot be identified, is designed to serve an Army technical training school. The layout includes four 150-ft. runways 5,260 to 5,640 ft. in length, built to carry medium planes, plus several 50-ft. taxiways and a 400-ft. apron. The apron is of concrete. Runways and taxiways consist of a 2½-in. bituminous mat on an 8-in. graded rock base supported on a carefully processed sub-base of selected material.

The original plan was to widen and extend the existing runways, which, under WPA, had been built up on a filled section raising the profile above the general level of the field. But

the new design wheel loading of 15,000 lb., which was greater than the commercial plane loads originally using the field, necessitated a redesign of the runways, together with extensive removal and replacement of un-

---

**A**N important war-time paving development is the Corps of Engineers' application of the California bearing ratio method to flexible runway design. On the following 12 pages **ROADS AND STREETS** presents two related articles on this subject. Beginning on this page is an account of an interesting and difficult airport construction job, one of the first to apply the method. On pages 44 to 48 is a review of the design method and its background.

---

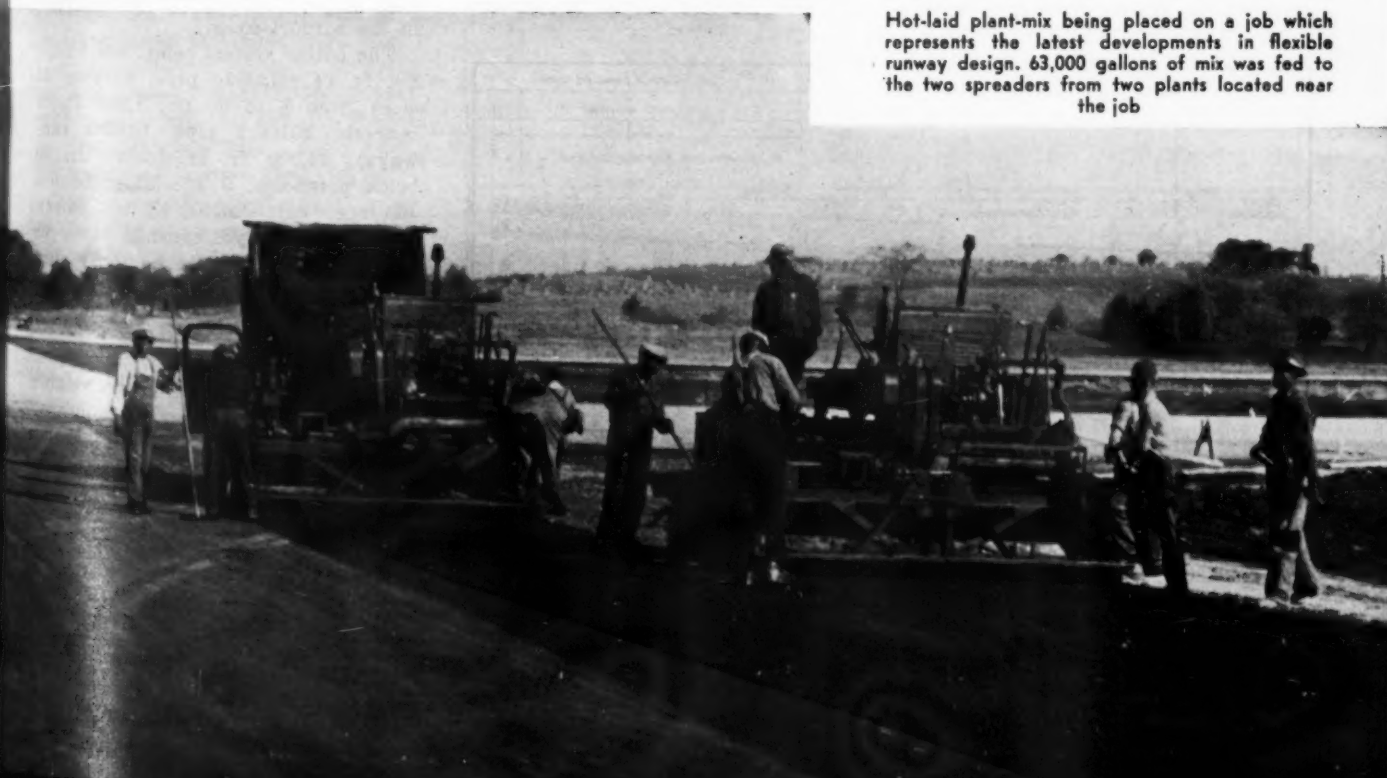
satisfactory material to get a sub-base of adequate stability.

Like all military projects last year, this one had the hurry sign out. But in addition to the difficult drainage conditions it was beset with weather troubles; a total of 11.0 inches fell during 45 days of rain or "trace" in the normally dry months of July, August and September. There were 21 more such days in October and November. Work began July 9. By August 1 only 10% had been completed. But by stepping up the job whenever weather permitted, all paving was finished by frost.

The accompanying charts show something of the speed. Drainage, excavation and borrow operations were on a basis of two 10-hour shifts. Paving work was usually done in one shift of 10 to 12 hours. Sunday was just another day.

The strategy in construction was to complete the drainage system with all

Hot-laid plant-mix being placed on a job which represents the latest developments in flexible runway design. 63,000 gallons of mix was fed to the two spreaders from two plants located near the job







Excavating for sub-base. The California bearing ratio method was used to determine the design base thickness with available materials

possible speed, starting with culverts under runway areas, so that filling could proceed over the entire area in one operation as soon as construction started. Excavating crews stepped out ahead, so that at no time did their work interfere with placement of borrow filling.

#### Drainage System

Perhaps the most remarkable show of speed was in culvert and drainage installation. Over 76,000 lin. ft. of lines were put in in a period of 23 days—a record the builders believe to be without equal considering the messy conditions. Four outfits, using back-hoes, draglines, and a few trenchers in better ground, finished

the work in a fraction of the time originally planned.

The drainage system on this field is unusual in that, although a high water table prevails, no true field subdrainage is provided. The system is designed primarily to handle surface run-off rapidly and to have only a limited effect on the water table. It is based on the decision to build the runway sub-base for adequate load-supporting power when saturated.

To drain the subgrade, shallow edge drains consisting of some perforated clay and some skip pipe, both laid with open joints, were installed along all runway edges. Drains were backfilled with a graded mixture of stone and sand designed to prevent

infiltration of silt and fine sand, and still be sufficiently porous to act as sub-surface drains for the base. They were sealed at the surface to prevent them acting as other than sub-drains. Drains range from 2½ to 5 ft. in depth. About 180 ft. back from these drains, along the edges of the shoulder fill and distributed over the field enclosure, are storm inlets and tight-jointed collecting drains. Both the edge drains and the surface collecting system drain into adequate open ditches leading to a neighboring lake. The ditch system surrounds the airport on three sides and is effective in intercepting surface water from the surrounding hills and is counted on to help in lowering ground water levels in the airport area.

The entire system comprises 73,400 lin. ft. of concrete pipe, varying in sizes from 8 to 60 in., 3,350 ft. of concrete culvert pipe (under runways), 44,000 ft. of drain tile, 63 brick manholes, 9 special manholes, 134 open catchbasins, 81 box inlets. Also 9,100 cu. yd. crushed stone or sand backfill for culverts under runways and 16,000 cu. yd. of aggregate in the edge drains.

#### Sub-Base Construction

In the excavation, too, notable speed was maintained. Ten thousand yards a day was planned, and 15,000 cu. yd. peaks attained when weather permitted. The only interruption, other than for rains, was due to the existence of extensive farm tiling under the old runways. When these were broken into, water seeped into adjacent ground, saturating it and miring down the grading equipment.

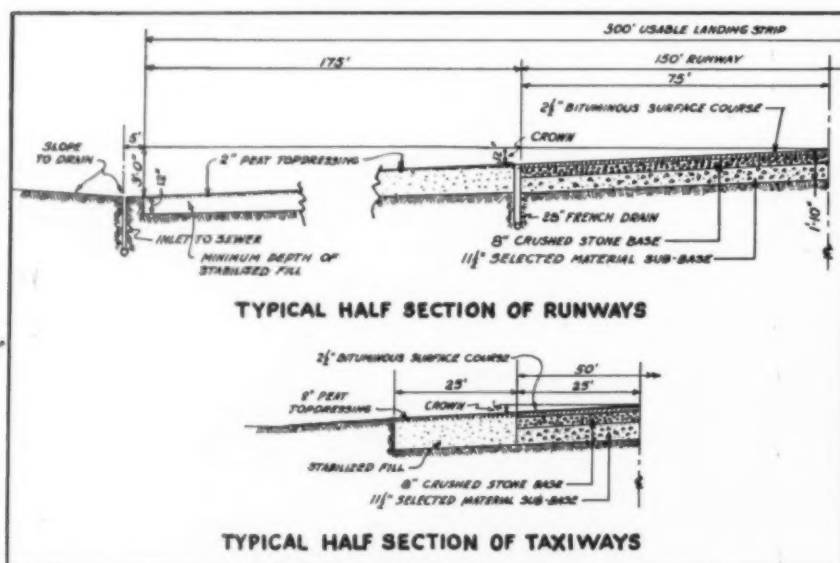


FIG. 1—Typical cross sections of runways and taxiways



In preparing the sub-base all unsuitable soil including, peat, muck, frost-heave and any other unstable material or material that would not consolidate readily, was first excavated from the runway areas and disposed of away from the shoulders and pavement areas. About 600,000 cu. yd. of excavation, almost entirely peaty black soil, was taken out using self-loading wheel-type scrapers both tractor drawn and self propelled. Excavated areas were then back-filled with selected borrow material. Broken-up asphaltic concrete pavement and sub-grade materials from the old runways were also used as sub-base fill. Where proper mechanical stabilization could not be obtained, one or more layers of 3½-in. max. crushed stone were placed in depths from a few inches to 2½ ft. About 63,000 cu. yd. of stone was so used.

A maximum of 10 scraper units, 12 to 24-yd. capacity, moved as high as 1,000 cu. yd. per hour with about 1,000 ft. average haul. All excavation was spoiled within 1,500 ft. of pick-up.

In general the runway profiles were raised approximately 3 feet above the level of the original field and constructed to a boulevard section 500 ft. wide with a maximum transverse grade of 1%. While no general raising of the balance of field was involved, it was necessary to raise the grade under about half of the large concrete apron. After removal of unsatisfactory black soil, about three feet of fill was placed under apron area, using selected borrow.

The original intention was to fill with sand or pit-run gravel, but an adequate supply was not obtainable within economic hauling distance, and nearby selected materials were tried. After troublesome attempts to process and compact soils from several sources, a supply of sandier glacial till was uncovered within short haul, and subsequently gave good results.

Borrow material, hauled largely by trucks with several self-loading scrapers assisting, was deposited and spread with bulldozers and blades in 6-in. layers (4-in. max. after compaction). To insure uniform compaction the processing methods were adjusted constantly to meet variations in the texture of the pit-run materials. Plowing with disc or roto, harrowing, drying, sprinkling, rolling with either sheeps foot or wobbly rollers—a combination of these had to be worked out from day to day, and even hour to hour, to produce a sub-base having the proper compaction and moisture content. Water was applied uniformly with pressure tank trucks before and during rolling when

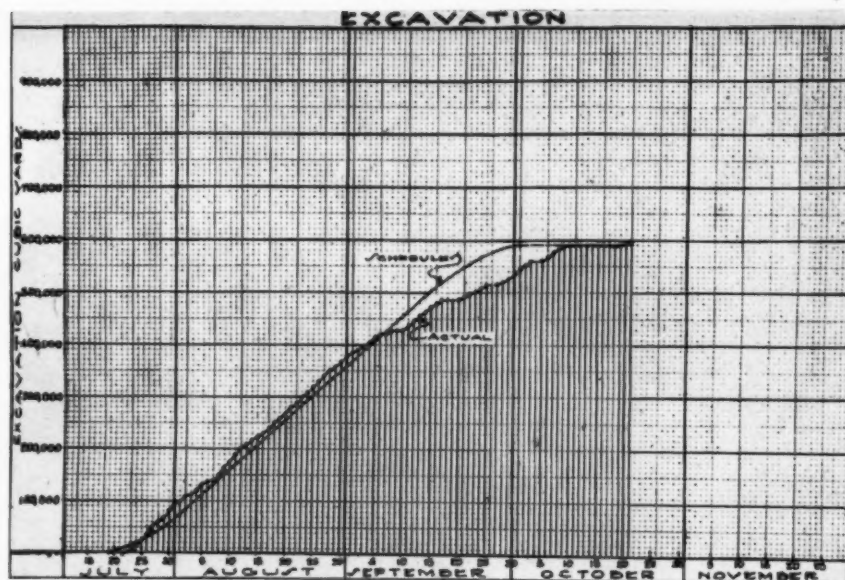


FIG. 3—This chart shows graphically how the wet September slowed up the finish of excavation

## SEWERS

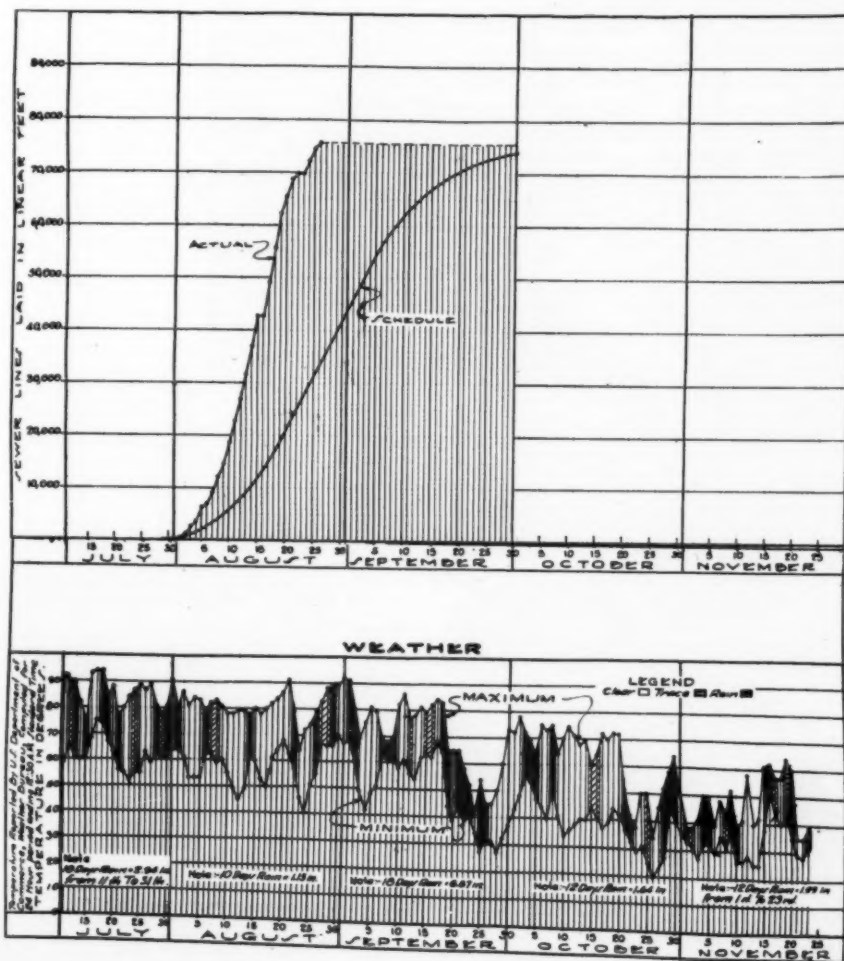


FIG. 2—Progress sheet for sewer construction, as kept by the general contractor, showing delays in relation to weather conditions. A fairly dry August was capitalized by rushing sewers so that field-wide grading operations could begin



Upper left: This airport presented a difficult drainage problem involving about 15 miles of pipe. Junction of a runway (left) with field drains

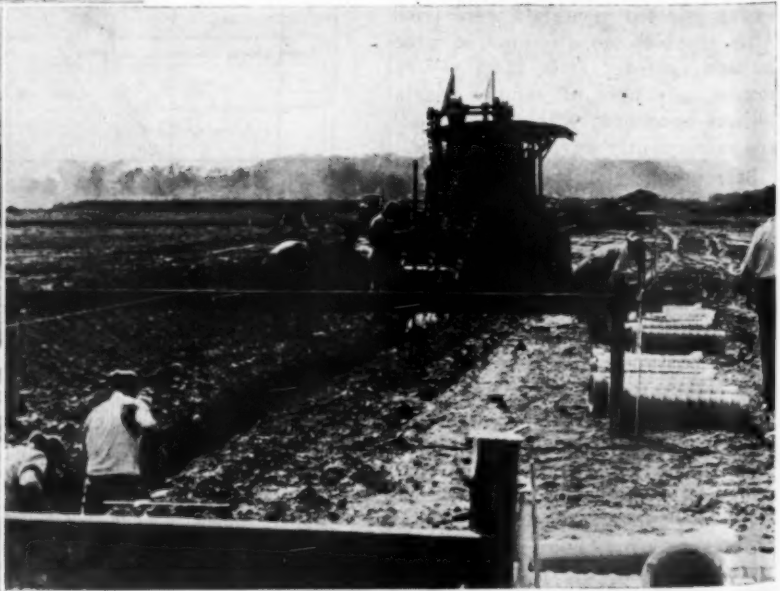
Upper right: Perforated clay tile waiting installation for stone-back-filled edge drains



Center left: Corrugated iron culvert near end of one runway

Lower left: Drainage of this field required nearly three hundred manholes, catch-basins and inlets

Lower right: Ditching machines were used for laterals when ground conditions permitted



water  
period

Even  
inspe  
up an  
ness  
face  
tion  
which  
istics  
tive  
placed  
was l  
traffic  
until  
and s  
not p  
dug o

"C

The  
in de  
quires  
sampl  
ticles

San  
x 6-  
when  
consi  
then  
2,000-  
specir  
ing, t  
tratio  
at th  
were  
tain  
in., u  
and e  
lowin

Penetr  
0.1  
0.2  
0.3  
0.4  
0.5

The  
95%  
ing t  
sity t

Pro  
tensi  
called  
moist  
runw  
surfa  
sub-b  
were  
field  
ings  
orato  
speci

A  
mater  
areas  
On



water was required in the few dry periods.

Even with continual testing and inspection it was necessary to plow up and re-process many areas. Nearness of the ground water to the surface frequently led to a pumping action under heavy passing equipment which altered the physical characteristics of the base before the protective macadam covering could be placed. Where it was felt such action was likely to occur, truck and other traffic was controlled over these areas until after the section was completed, and sections of sub-base which did not pass soils laboratory tests were dug out and rebuilt.

### "California" Bearing Ratio Test

The following procedure was used in designing the base thickness required with available materials. Soil samples were prepared with all particles over  $\frac{3}{4}$ -in. size removed.

Samples sufficient to make a 5-in. x 6-in. diam. cylindrical specimen when compacted, were moistened to consistency for proper compaction, then consolidated in a mold under 2,000-lb. pressure per sq. in. The specimen was soaked 4 days. In testing, the loads required for the penetration of a piston with 3 sq. ft. area at the rate of 0.05 in. per minute were recorded. Loads required to obtain penetration in increments of 0.1 in., up to a total of 0.5 in., were noted and expressed in percent of the following values:

Penetration	Load in lb. per sq. in. soaked specimen
0.1" .....	1,000 lb.
0.2" .....	1,500 lb.
0.3" .....	1,900 lb.
0.4" .....	2,300 lb.
0.5" .....	2,600 lb.

### Subgrade Test Procedure

The sub-base was compacted to 95% maximum density in layers using the AASHO compaction and density test T-99-88.

Processed material was tested intensively under a program which called for 15 to 20 compaction and moisture tests per quarter-mile of runway. Samples were not merely surface samples but from the entire sub-base depth. Four testing parties were employed, each with complete field laboratory equipment. The findings were correlated in a central laboratory under direction of a soils specialist.

### Borrow Pit Operation

A total of 615,000 cu. yd. of base material was excavated from borrow areas.

Originally only one pit was planned,

but due to intensive traffic on the borrow road and limited working area in the pit, a second and third pit was opened up progressively. The three pits were worked with five shovels and one dragline, with ten hauling scrapers helping in the nearest pit. Scraper units averaged 1,000 cu. yd. an hour, or 20,000 yd. per day in good going. As high as 150 4 to 8-yd. dump trucks were also used. Top-soil from borrow areas was saved and spread back.

As an example of the expedients used to save time, the sub-contractor on borrow-pit excavation sent a fleet of seven 15 to 22-yd. wheel scrapers (Tournapulls) over the highways 700 miles from another city. These units, heaped with crane buckets and other paraphernalia, made the trip between a Friday night and a Tuesday morning, using 700 gal. diesel fuel each. Overtaxed rail facilities were relieved, time saved, and the move done at half the expected cost.

FIG. 4—Extra borrow yardage over original estimate also had to be rushed toward the close

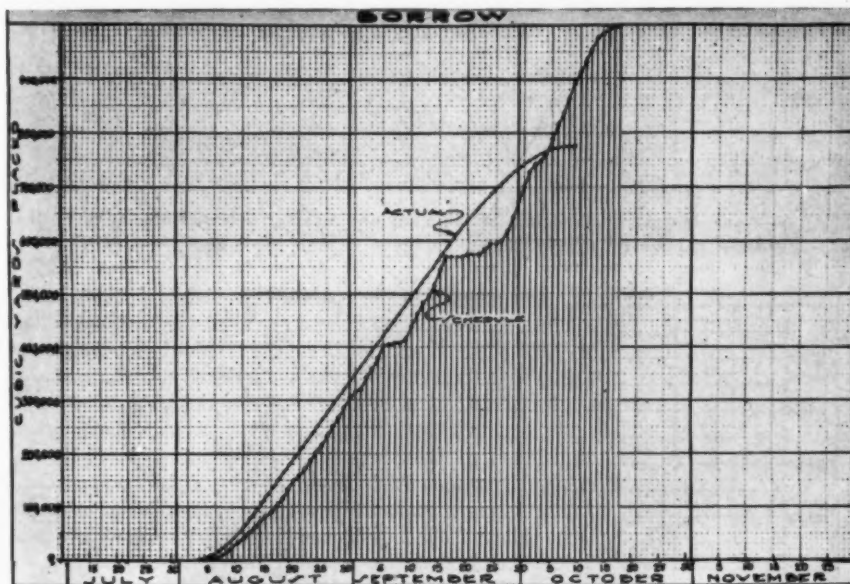
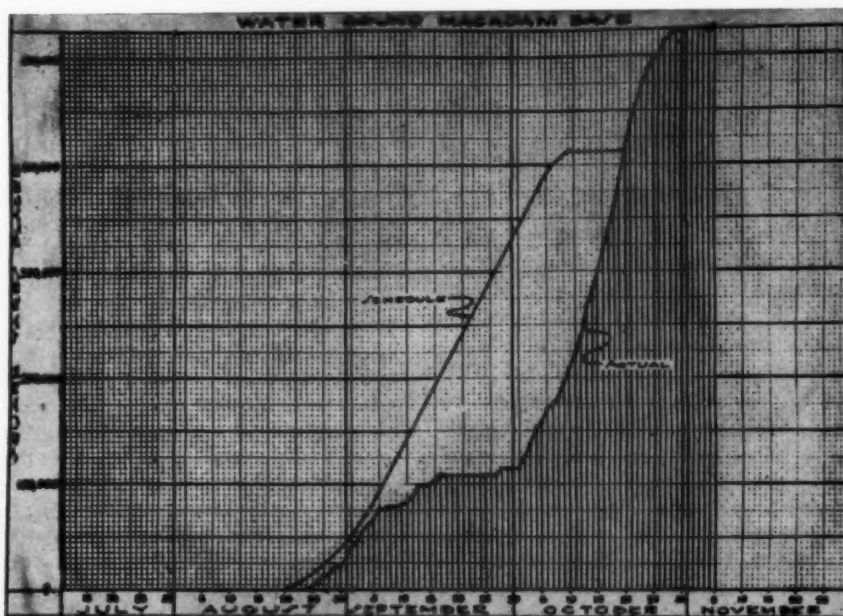


FIG. 5—Stone base construction was hardest hit by weather—but a 20,000 cu. yd. daily pace in October made up for lost time. (Chart shows total equivalent yardage of 8-in. base, actual thickness averaging greater)





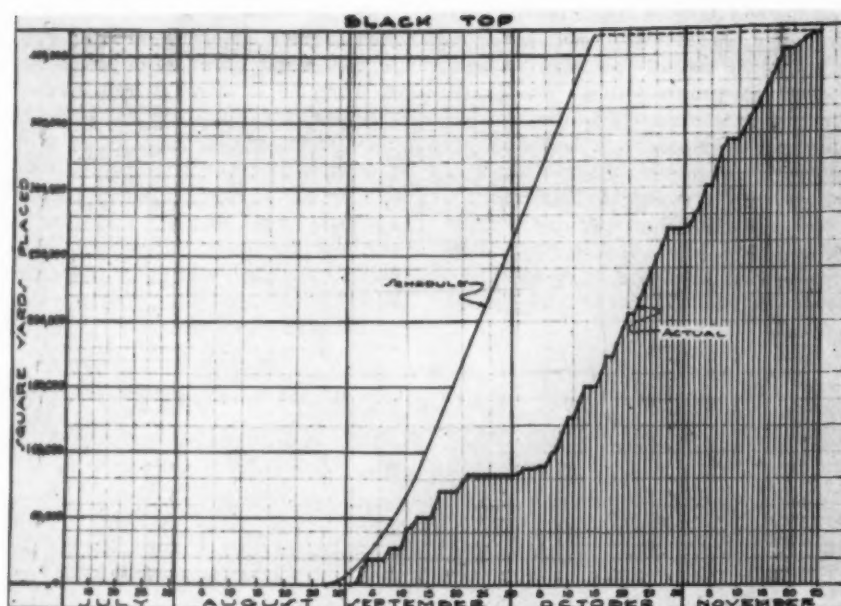


FIG. 6—Again the chart tells a tale of subgrade and weather delays. Note, however, that black-top was placed with fairly uniform speed on days when work could progress

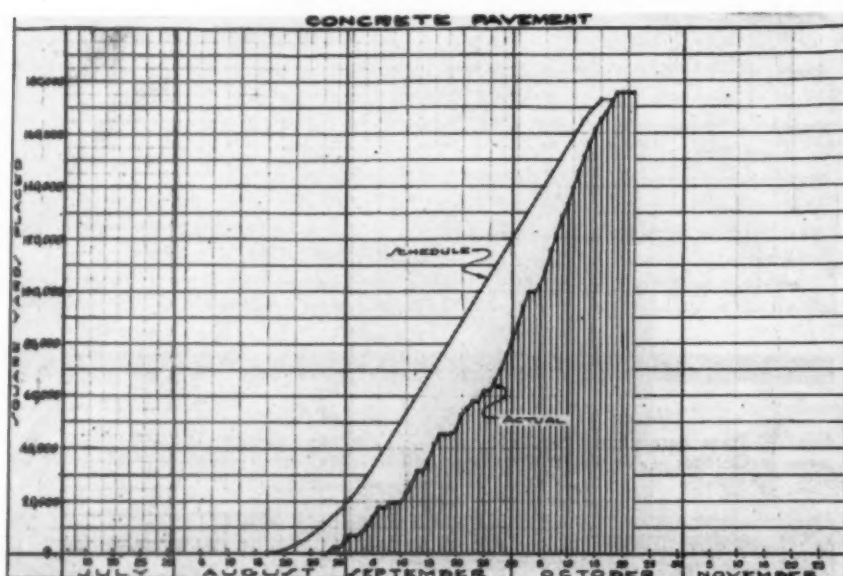


FIG. 7—Using four dual drum pavers, over 6,000 sq. yds. of 9-6-9 concrete apron was placed in one shift on good working days

#### Crushed Stone Base

Original specifications called for 8 in. of water-bound macadam under all runways and taxiways, to consist of 695 lb. of graded limestone coarse aggregate per sq. yd. with voids filled with 210 lb. of screenings, and 20 lb. of additional screenings per sq. yd. on the sub-base, and with stone spread and rolled in 2½ to 4-in. layers and sealed with more screenings. Difficulty in getting proper penetration of screenings, however, led to the use of selected crusher run material, or mixture of part of the screenings with the stone at the quarry. Spreading was done with spreader boxes and blades. The rolled surface was thor-

oughly checked with a 10-ft. straight-edge for ½-in. max. tolerance.

Crushed rock base construction suffered the greatest delay of any operation. Almost no progress was made during September, due to the heavy rains and consequent lack of prepared sub-base, but to offset this delay over 300,000 sq. yd. was placed in October. (Again, see chart.) The stone sub-contractor, working from an adjacent quarry, speeded up stone deliveries to 8,500 cu. yd. per day to keep up. Four portable crushing plants, located one mile from the job, stockpiled material in advance of the peak of construction and loaded with two shovels to supplement crusher deliveries.

#### Bituminous Top

The bituminous macadam topping for runways and taxiways consisted of 2½ in. of hot-laid plant-mix, penetration 120-150 at 77 degree, 100 g. 5 sec.; grading, AASHTO method T-11 and T-27.

Before applying, the stone base was given a ½ to ½ gal. hot road-oil prime coat (MC-1) and the application allowed to dry for 48 hours. This operation was always conducted on a dry stone base, preferably when air temperature was above 50 degrees. This precaution caused delay in applying the wearing course but was considered advisable.

The wearing course was placed with two mechanical spreaders, rolled, and given a seal coat followed by sanding from spreader boxes. Sand not embedded was removed with a power broom. The hot mix was furnished by two plants located near the job, of 125 and 175 tons per hour capacity. The airport surfaces involved 63,000 tons of plant-mix, 110,000 gal. prime coat, 91,000 gals. seal coat, and 2,650 tons of sand for seal. The rolled surface all was checked with a 10-ft. straight edge for ¼-in. max. tolerance.

The finished runways were checked with bearing plate tests and by passing scrapers loaded to excess of design load.

#### Concrete Apron

The 400-ft. apron comprised 177,000 sq. yd. of 9-6-9 plain concrete pavement, with expansion joints every 80 ft. longitudinally and 100 ft. transversely. Only dowels are at transverse construction joints.

Concrete was placed with one 34-E dual-drum and three 27-E single-drum pavers. Dummy joints were placed with a ribbon machine. Pavement was placed in 25-ft. strips, two pavers in tandem, casting respectively to the near and far sides of the strip. In spite of rain on 24 days out of 30, it is notable that a large part of the job was placed during September. The ability to do this was due to the previous granular fill over this area. Gravel aggregate was supplied from an enlarged local commercial plant.

Bulk cement was unloaded from hopper-bottom or plain box cars into two silos by conveyor. Two material-handling plants each with two 120-ton bins were used for batching.

#### Field Surface

Along each runway are 150-ft. shoulders of filled material, topped with black soil selected to insure quick turf development. About 1,000,000 sq. yd. of 2-in. peat top dressing was placed, using material largely from

topping  
consisted  
ix, pene-  
e, 100 g.  
hod T-11

base was  
road-oil  
applica-  
urs. This  
ted on a  
when air  
degrees.  
y in ap-  
but was

s placed  
rs, rolled,  
owed by  
es. Sand  
with a  
was fur-  
near the  
hour ca-  
involved  
000 gal.  
coat, and  
he rolled  
a 10-ft.  
ax. tol-

checked  
by pass-  
s of de-

177,000  
te pave-  
every 80  
t. trans-  
t trans-

one 34-E  
le-drum  
e placed  
ment was  
avers in  
to the  
trip. In  
of 30, it  
of the  
otember.  
e to the  
is area.  
ed from  
plant.

ed from  
ars into  
aterial-  
wo 120-  
ng.

150-ft.  
topped  
re quick  
,000,000  
ing was  
ly from

the runway excavation. This was disced in. Seeding with blue grass plus a quick cover crop was completed before winter.

Of special interest, in view of the vital importance of conserving transportation, is the fact that all fill and aggregate materials were obtained within  $3\frac{1}{2}$  miles of the job; most within  $1\frac{1}{2}$  miles. By a stroke of good fortune the only limestone source in the entire area was right adjacent to the field.

This airport job is part of an extensive Army post built under the Corps of Engineers management. A firm of consulting engineers, acting as architect-engineers, furnished service on design and supervision. Work was done by a general contractor with numerous sub-contractors on drainage, grading, stone production, asphalt and concrete paving. Progress was controlled by daily use of an elaborate system of progress control charts in a chart room at the site.

### \$3,000,000,000 Post War Program Proposed

A proposed post-war highway program calling for the expenditure of not less than a billion dollars a year of Federal funds for a period of at least three years was outlined March



Dowels at transverse construction joints were the only steel used in concrete aprons

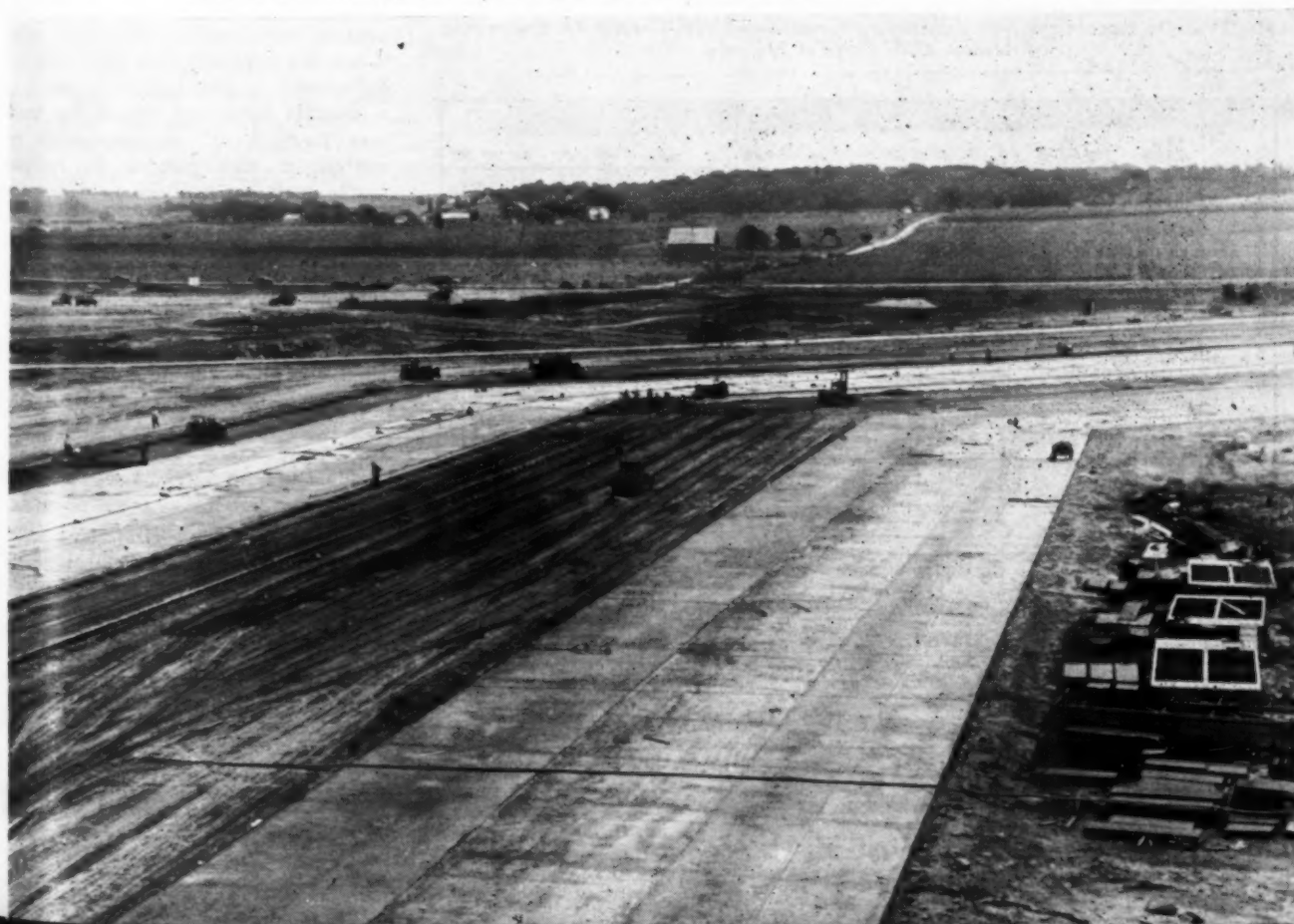
5 to Major General Philip B. Fleming, Federal Works Administrator, by the American Association of State Highway Officials.

### WPB Approves Funds for "Remote" Roads

Expenditure of more than \$4,000,-

000 for roads to remote deposits of scarce war materials in six western states has been approved by the war production board, it was announced recently. The building program includes: Idaho, 18 roads, 352 mi., \$759,530; Oregon, 18 roads, 227 mi., \$747,825; Washington, six roads, 66.46 mi., \$498,259.

Much of the 177,000 sq. yd. concrete apron was laid in a single month in spite of 24 days rain in 30.





# Design of Flexible Pavement Foundations

## Introduction

The U. S. Engineer Department was assigned the design and construction of all military airfields in the fall of 1940. The design was limited to three types of fields—15,000, 37,000 and 60,000 maximum wheel loads.\* After a thorough study of highway pavement design methods, it was realized that there was no conclusive information available from which to extrapolate designs for the heavier airfield wheel loads. The Office of the Chief of Engineers began a thorough investigation into pavement designing methods, to arrive at the best method for the higher loads.

## Impact

The previous policy, on commercial fields, was to design for a 25 per cent landing impact on all runways. After much study, it was conclusively shown from tests and field observations that this criteria should be reversed and that the taxiways, aprons, and turnarounds only should be designed for 25 per cent increases in load to allow for the increase in deflection resulting from a static load

By T. A. MIDDLEBROOKS

Chief, Soil Mechanics Unit, Office of  
Chief of Engineers, Washington, D. C.

and vibration during the warming up of airplane engines and slow taxiing.

## Preliminary Investigations

### Field Bearing Test

Based on the experience in designing other structures, it was concluded that the load-bearing tests conducted in the field on the soil involved would be the most accurate method of extrapolating highway experience, and possibly for designing directly for these heavy wheel loads. This investigation at first, therefore, was concentrated on the best methods of conducting field bearing tests, interpretation of the results, and their application to pavement design.

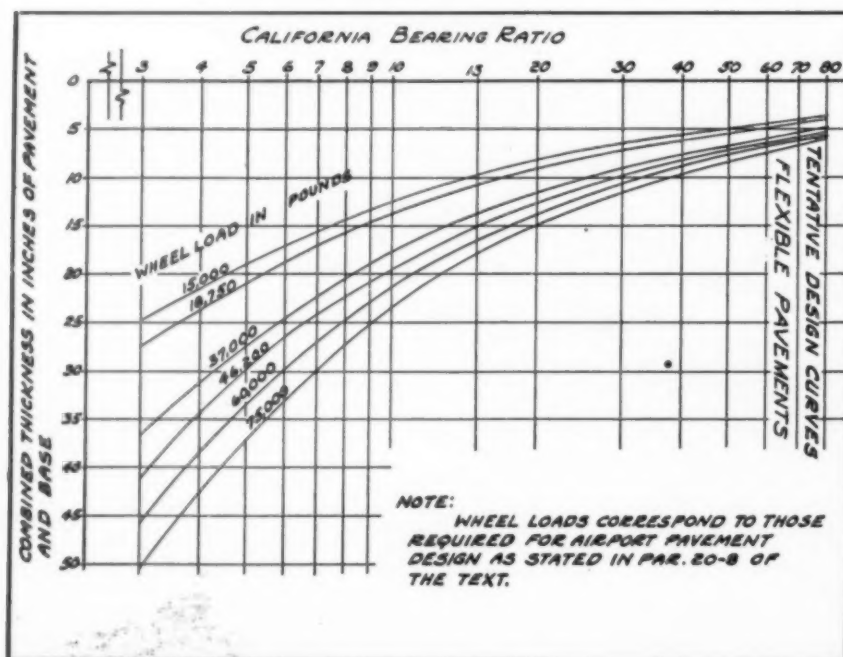
First, the method was investigated by actually going into the field and conducting tests on pavement and subgrades. After experimenting with various speeds of loading, a most important factor in the results, it was decided to allow sufficient time for full consolidation to take effect

for all increments of loading. The investigation showed that this method of conducting field bearing tests, although somewhat conservative, gave much more consistent and reliable results than a rapid rate of loading.

The next question was allowable deflection. The Asphalt Institute and others had arrived at a figure of  $\frac{1}{2}$ -in. based primarily on the action of the surface course. Experience of the Department in soil testing throughout the U. S. indicated that the maximum possible deflection, before the soil would actually fail, would not exceed .25 in. Subsequent investigations, conducted on the Williamsburg test road in Virginia and on airfields, showed that this critical deflection would have to be decreased to .2 or less. It was these results that were reported to the Highway Research Board in December, 1941. It was pointed out, however, in that paper, that for the large number of repetitions this allowable deflection would quite probably be decreased to a figure approaching .1 in.

To check further on the field bearing test on different types of base course materials, a test section 50 ft. wide was constructed at a Virginia airfield. This section was composed of 14 units, with 7 different types of pavements or base courses. This section was to be subjected to static field bearing tests only. However, after it became apparent that the allowable deflections in the subgrade itself of a flexible pavement would be much less than .2 in., as previously reported, it was decided to conduct traffic tests as well as field bearing tests on the surface and subgrades. After less than 100 passes of a 20,000-lb. wheel load (12-cu. yd. scraper), 10 of the 14 units failed. The average deflection was about .15 of an in. These tests showed conclusively that the allowable deflection would have to be much less than originally expected. As a result of these and other field bearing and traffic tests, an attempt was made to lay down definite criteria of design based on the fieldbearing tests. However, it was soon apparent that the critical deflection was not a fixed value, but varied with numerous factors, such as type of soil, rigidity of

Fig. 1—Bearing ratio curves as developed for typical plane wheel loads, and same loads plus 25%. The four sketches with this article are reproduced from Chapter XX, Engineering Manual, U. S. Corps of Engineers



\*The type of field, wheel load, contact pressures, and contact areas, for these three designs are given in Chief of Engineers Engineering Manual, part II of Chapter XX on Design of Runways, Aprons and Taxiways.



surface course, number of repetitions, and size of contact area.

### California Bearing Ratio Test

In the meantime, the possibility of using the California bearing ratio test was being investigated. This method has been used by the California State Highway Department since 1929, and they have set up total thickness curves for flexible pavements based on actual highway experience for light and heavy highway traffic. After comparing this method and its proven background, and the field bearing test method with its numerous complications, it was decided, for the present at least, to stop theorizing as to the best way of interpreting field bearing test results and to adopt the California bearing ratio test as a method of design.

In past highway work, numerous attempts have been made to predict the supporting characteristics of soils by their grain size analyses, liquid limits, plastic limits, and other such tests. None of these tests have proven satisfactory. The stability of soils varies with numerous factors; such as gradation and shape of particles, density, plasticity, and original undisturbed structure. The present method of testing, based on grain size and Atterberg limits, tries to evaluate each of these factors individually, whereas the California test roughly evaluates their collective effect. In earth construction, the Department used the shear test (triaxial and direct) for determining the stability of soils. This test collectively evaluates all of these factors and gives a strength which is used in the design of structures on, or composed of, soil. However, due to the lack of field correlation, it can not be used at present on pavement design.

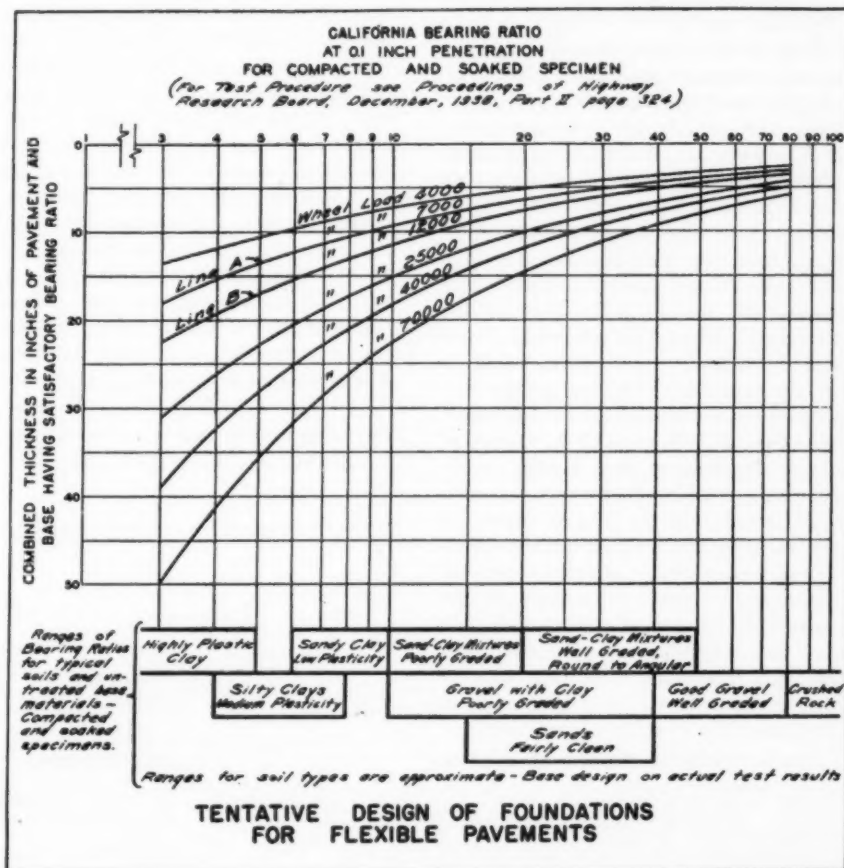
### Extrapolated Design Curves

After the decision to adopt the California method, it was necessary to extrapolate curves for the higher wheel load, since the California method has been proven satisfactory only up to about 12,000 lbs. With the consultant advice of Dr. Arthur Casagrande, Harvard University, and O. J. Porter, California Highway Department, the Office of the Chief of Engineers arrived at extrapolated thickness curves for wheel loads up to and including 75,000 pounds.

No definite formula was used in extrapolating, but several methods of load distribution, such as the angle of spread and elastic theory, were used as a rough guide.

Because soil mechanics is not an exact science, the Department doubts

Fig. 2—1. Line "A"—California Experience for Light Highway Traffic. Line "B"—California Experience for Medium Heavy Highway Traffic. (See California Highways and Public Works, November, 1941, page 7.) 2. Thicknesses derived from this chart are for average conditions based on a tire pressure of 60 lbs. per sq. in. and they should be increased or decreased up to  $\pm 20$  per cent, depending on tire pressure, thickness and type of pavement and base, characteristics of imported fill, ground water and drainage conditions, possible effects of frost action, and frequency of loading. 3. The minimum Bearing Ratio shall be used for determining the required thickness of pavement and base for total thicknesses of less than 6 inches instead of the Bearing Ratio of 0.1 inch penetration.



whether it will ever be possible to arrive at a true scientific solution. Possibly, in the long run, all designs of pavements on soil will have to be based on empirical results. Of course, these results will have to be tied in from job to job by some type of laboratory or field test. It appears that the California test is the best presently available. Although empirical results must be depended upon and a truly scientific solution may never be reached, scientific investigations are essential to properly interpret the empirical data.

### Service Behavior Tests to Check Design Curves

Before submitting the extrapolated design curves to the field, it was considered necessary to check the extrapolations. One large test section, constructed in California, was subjected to 5,000 to 53,000-lb. wheel loads. Large-scale traffic tests on

actual airfield pavements were started at the same time. One flexible pavement, on a sandy clay subgrade in Alabama, was tested with 20,000 and 50,000-lb. wheel loads; one on a black clay soil in Texas, with a 20,000-lb. load; one on a clay soil in Montana, with 20,000-lb. A soil-cement stabilized surface on a select base over a black clay was tested in North Dakota. Rubber-tired carry-all scrapers were used for the traffic tests, providing contact pressures and areas comparable to the actual planes on which design was based. Results were studied, and, after sufficient data were obtained which showed that the extrapolated curves were reasonably accurate, the design curves were transmitted to the field for use in the design of flexible pavements.

### Application to Design

The exact procedure used by the Department in designing foundation

or base courses using the California bearing ratio test is given in the following paragraphs. Fig. 1 shows the design curves now being used for flexible pavements. Note that 6 curves are given—3 for the static load for the 3 types of fields designed for 15,000, 37,000 and 60,000-lb. wheel load; and three for the 25 per cent increase over static load, for aprons, taxiways, and turnarounds.

The first design step is to make a soil survey of the field and of all natural sources of borrow from which base course material and aggregates can be obtained. Representative samples of the subgrade are taken into the laboratory and compacted at optimum moisture and maximum density, based on the Modified AASHTO method. These samples are then soaked for 4 days and tested by the Standard California bearing ratio test, involving penetration of a 3-sq. in. piston into the soil at the rate of 0.05 in. per min. (for details again see Part II, Chapter XX, Corps of Engineers Engineering Manual). The resulting bearing ratio value is then substituted directly in the curves to arrive at a total pavement thickness (base and surface course) over the subgrade. Then, to arrive at the suitability of base course materials, the same type of test is conducted on this material from all sources, and each material used in design as indicated by cost and availability.

As a typical example of application, consider a taxiway for a 37,000-lb. wheel load corresponding to a design load of 46,000-lb. (37,000 + 25%); the top 9 in. of subgrade will be compacted and the bearing ratios of the compacted subgrade and available materials for base course construction are as follows:

Material	Classification	California bearing ratio of compacted and saturated samples as determined by test, in percent
Compacted subgrade	Sand Clay low plasticity....	8
No. 1	Sand-clay mixture poorly graded....	15
No. 2	Sand .....	30
No. 3	Crushed stone or stabilized gravel..	80

The total thickness and thickness of the various base course layers are determined as follows:

(1) *Total Thickness* of base course and pavement will be governed by the bearing ratio of the compacted subgrade. From the design curves, the required combined thickness above the compacted subgrade (bearing ratio 8) is 22 in.

(2) *Thickness of Base Course Layers*: The total thickness of 22 in.

base course and pavement may be composed of materials Nos. 1, 2, and 3, and a wearing course (pavement) as shown in Fig. 2(a). The design thickness of each layer will depend on the relative cost of construction and the bearing ratio of each material. The first step in design is to determine the layer thickness required if all three materials are used. Material No. 1 which has the lowest bearing ratio would form the lower layer, and Material No. 3, having the highest bearing value, the upper layer. The minimum depth of more stable material required above a layer of No. 1 material is 15 in., corresponding to bearing ratio 15 on the design curves. Likewise, the minimum depth required above a layer of No. 2 material is 10 in. (bearing ratio 30). If the cost of placing material No. 1 is the least and that for material No. 3 is most, the most economical base course design would be as shown in Fig. 3(a). However, the base course may also be designed, if economical, using only No. 3 ma-

terial or Nos. 2 and 3 in combination, as shown on (b) and (c), since material with a higher bearing ratio may be used in place of a material with a lower ratio. However, using a "high" material in place of a "low" does not permit a decrease in the total thickness of base course, which is governed solely by the bearing value of the subgrade. This example shows that the California bearing ratio method of design allows the rapid investigation of the economic possibilities and use of locally available materials.

One of the main advantages of the California test is the rating of subgrade and base course materials on a comparative basis. It provides an excellent means of selecting the best base course material for use directly under the pavement and allows the use of inferior base course material on the bottom of base courses. In this manner, locally available materials can be used more extensively than heretofore in getting a balanced design. In many

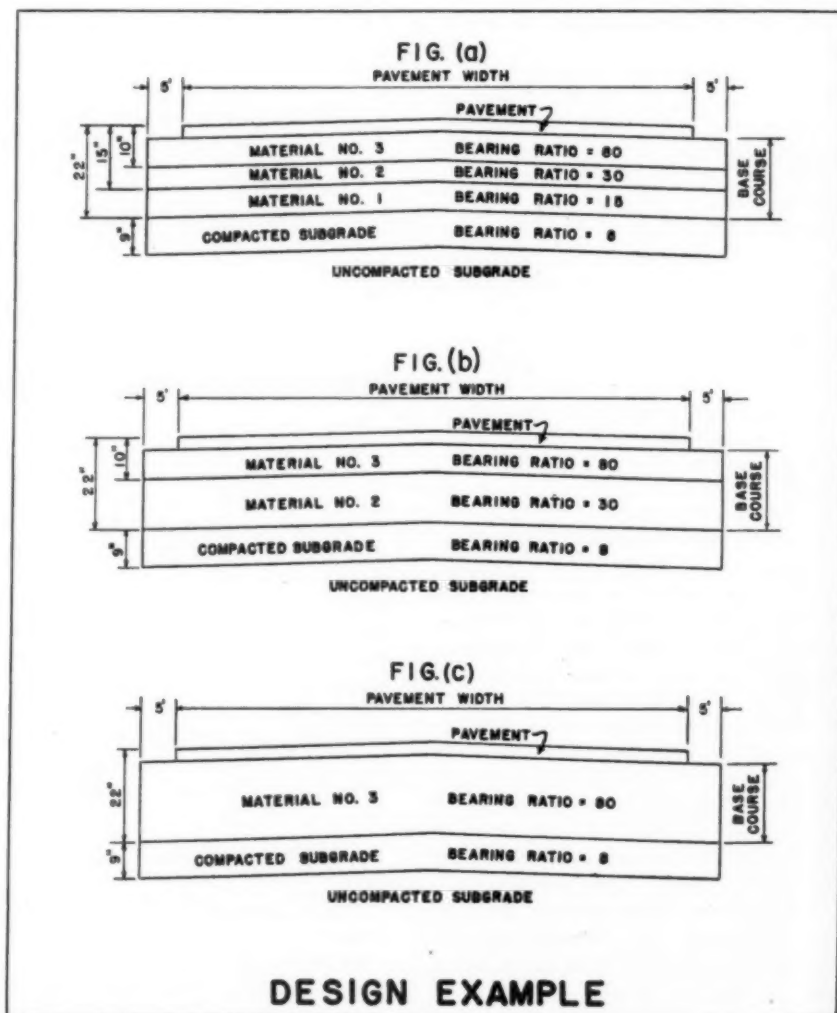


Fig. 3—Showing various economic combinations of materials, as referred to in accompanying article.



cases, field grading operations can be controlled by this method so that the best materials are selected for finishing off the subgrade with considerable cost saving. For instance, if the subgrade is a plastic clay, then a sandy clay or a silt might be used directly over the plastic clay, thereby minimizing the quantity of imported materials.

It should be emphasized, in the application of these or any other criteria of design, that the results actually obtained during construction are of utmost importance. For example, in designing for 95 per cent compaction, if only 85-90 per cent is obtained, it is obvious that the thicknesses determined from the laboratory test on compacted samples will not be representative of the actual condition in the field. Therefore, all laboratory tests must be made as near as practical to the conditions which can be and are obtained during actual construction. If greater compaction than is indicated by the Modified AASHO can be obtained in

the field, then the design should be based on this increased compaction. If it cannot be obtained, due to the lack of heavy equipment or for other reasons, then the design should be based on a density comparable to that actually obtained. The Engineering Department with its wide experience in embankment construction, realized at the beginning of the airport program that control of compaction in the field was a prerequisite to good engineering design. Therefore, every attempt has been made to set up compaction requirements which were the maximum that could be obtained. Past experience of the Department had shown conclusively that better compaction than was indicated by the Standard AASHO Proctor test could and in most cases was actually being obtained in the field. Therefore, the Modified AASHO (comparable to California road requirements) method of compacting the soil in the laboratory was adopted. Subsequent investigations have shown that the

maximum compaction obtainable by presently available equipment is still much less than will result from a large volume of traffic. Every attempt should be made, therefore, to further develop the methods and equipment for increasing the density obtained during construction.

Especially noteworthy is that the tests for design are conducted on compacted and soaked specimens. The decision to design on the soaked specimen was based on California and other highway department experience. They have investigated moisture conditions under pavements and have shown that eventually a soil or base course material directly under the pavement will approach complete saturation. This saturation, however, does not necessarily represent a condition where the voids are 100 per cent filled with water. Tests on soaked specimens indicate approximately 85-95 per cent saturation, and the remaining 5-15 per cent is taken up by air in the soil. This degree of saturation results from capillary attraction and condensation of moisture. Since this moisture can not be drained, subdrainage systems do not decrease this moisture in the soil. Subdrainage systems are not used except where the ground water table is exceedingly high or where special conditions make it advisable to intercept the ground water flow.

### Frost Action

A most important factor in flexible pavement design, not covered by the California method, is the treatment required in soils affected by frost action. This problem has two phases: prevention of frost heaving (actual lifting of the pavement surface); and, the reduction in bearing (due to the effect of frost action on cohesive soils).

Exceptional or extreme heaving of the pavement, of course, should be prevented; but, for the heavy airplane wheel loads it is considered that the most important effect of frost action is the reduction in bearing.

The bearing value of a subgrade soil susceptible to frost action will be reduced during thaws. Where climatic and moisture conditions are favorable, silt and clay soils will be adversely affected by frost action. Although cohesive soils heave only slightly, their bearing value will be greatly reduced. The design of a pavement will depend upon the reduced bearing value of such a soil, unless it is removed and a base course is constructed to a sufficient depth to provide suitable reinforcement.

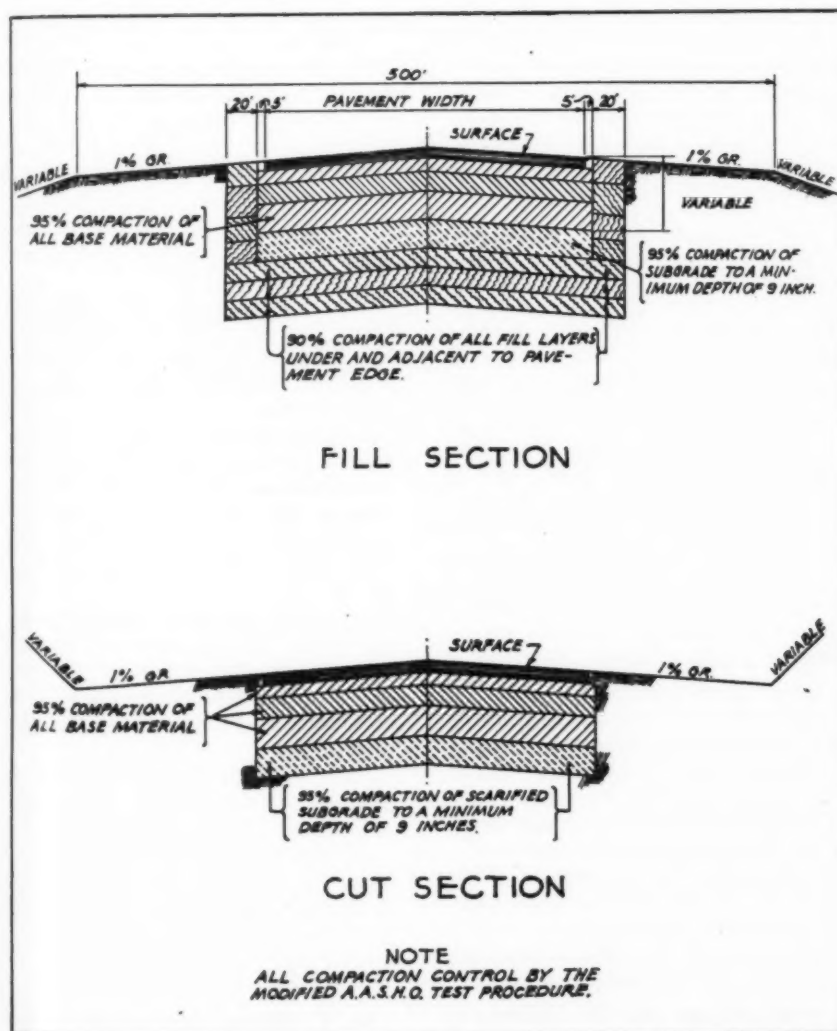


Fig. 4—Typical cut and fill runway sections.



Accurate methods of evaluating the actual bearing value in frost heave soils are not known. Highway experience indicates that, in areas subject to frost action, the base course of non-frost heaving material under a pavement used for highway loads should extend to a depth of at least 50 per cent of the average frost penetration, for suitable subgrade reinforcement. For the heavier airfield wheel loads it is logical to assume that the base thickness should be increased. The base course thickness so determined will govern only when it exceeds the thickness as required by the California bearing ratio test.

At this time, the effect of frost action on the bearing capacity can only be approximated from highway experience. It is reasonable to assume that if the thickness required for highway wheel loads is 50 per cent of the average frost penetration, it will have to be considerably greater than that, possibly 100 per cent of the frost penetration, for the 60,000-lb. wheel load. This problem is being investigated by the Department, and a more definite criteria of design for soils affected by frost action can be anticipated. Possibly in frost areas the maximum compaction of the soil can not be considered permanent, since swelling accompanying frost action will decrease its density. Results of the investigation now under way may show that the best method of design in frost areas is one based on undisturbed samples of natural soil subjected to frost action over a period of years. This assumes, of course, that all soils will revert to the natural density as a result of frost action, regardless of the degree of compaction obtained during construction. This approach, if true, will of course simplify design, since laboratory tests such as the California bearing ratio can be determined on samples of the soil at various depths for the design of flexible pavements.

#### Special Investigations

Several controversial items are being investigated. These include possible modification in design curves for sand; effect of using base or surface materials having an appreciable flexure strength; possibility of decreasing the thickness when a high bearing ratio material is used the full depth; possibility of using a lower bearing material directly beneath pavements for light loads; degree of actual saturation under pavements; further study of the California test and modification of design criteria in frost areas.

#### Summary

In summary, the California method of designing flexible pavements has been adopted as the best presently available method. Additional investigations are necessary to perfect its use for airfields. It is expected that modifications will be found necessary in the design curves, in the assumptions, and in the method of conducting the California bearing ratio test. Possibly a new method will result from these investigations, or sufficient data will be obtained to justify a return to the field bearing test method. The Department will not hesitate to make these changes when supporting data are available.

#### Acknowledgments

The investigations referred to were performed and the criteria of design were established, under the direction of the War Construction Section, Engineering Branch, Office, Chief of Engineers, with Major General Eugene Reybold, Chief of Engineers, Colonel James H. Stratton, Chief, Engineering Branch, and Lt. Colonel L. C. Urquhart, Chief of the War Construction Section. Gayle McFadden is Assistant Chief of the War Construction Section, in charge of Airports. J. L. Land is Chief of the Runways, Roads and Railroads Unit, and T. A. Middlebrooks is Chief of the Soil Mechanics Unit.

## A.G.C. Board Meeting Replaced 24th Annual Convention

The construction industry has the job during 1943 of adapting to constantly changing war conditions so that it can continue to make its maximum contribution to winning the war, President Oscar B. Coblenz said in reviewing the meeting of the Governing and Advisory Boards of The Associated General Contractors of America held in Chicago, February 15 and 16.

The smaller board meeting was held in place of the annual convention as an aid to the war effort. Discussion centered on labor matters, public relations, accident prevention, wartime restrictions, contract renegotiation, taxation, price regulation for construction, and future planning.

Speakers other than association members included Harry W. Loving, Chief, Price Adjustment Section, Corps of Engineers, War Department, who spoke on contract renegotiation; and Lieutenant Commander J. H. A. Brahtz, U. S. N. R., Procurement Officer, Ninth Naval District, on recruiting for the Seabees.

Oscar B. Coblenz, president, McLean Contracting Co., Baltimore, Md., was installed as president to succeed Dan W. Kimball, president, Owens-Ames-Kimball Co., Grand Rapids, Mich. William Muirhead, president, William Muirhead Construction Co., Durham, N. C., succeeded Mr. Coblenz as vice president. E. Marshall Rust, of Washington, D. C., vice president of the Rust Engineering Co., was reelected secretary-treasurer.

New chairmen and vice chairmen of the divisions were elected as follows:

Building Contractors' Division: Paul

M. Fogel, Fogel Construction Co., Kansas City, Mo., and Ford J. Twaits, Ford J. Twaits Co., Los Angeles, Calif.

Highway Contractors' Division: W. P. Roscoe, W. P. Roscoe Co., Billings, Mont., and Dwight W. Winkelman, D. W. Winkelman Co., Syracuse, N. Y.

Heavy Construction and Railroad Contractors' Division: A. Teichert, Jr., A. Teichert & Sons, Inc., Sacramento, Calif., and C. E. Lott, John F. Casey Co., Pittsburgh, Pa.

New members of the Executive Committee approved by the Governing Board were: Oscar B. Coblenz; William Muirhead; W. P. Roscoe; Paul M. Fogel; A. Teichert, Jr.; F. W. Parrott, Sioux City, Iowa; H. A. Dick, Portland, Ore.; Dan W. Kimball, Grand Rapids, Mich.; M. W. Watson, Topeka, Kan.; H. B. Zachry, San Antonio, Texas; E. P. Palmer, New York City; and A. E. Horst, Philadelphia, Pa.

Directors who were reelected to the Governing Board were: W. S. Bel lows, Houston, Texas; F. W. Parrott; C. A. Long, Bessemer, Ala.; C. E. Lott, and A. F. Eggleston, Meriden, Conn.

New directors elected were: C. F. Sanborn, Seattle, Wash.; A. Teichert, Jr.; Clarence Waterfall, Ogden, Utah; C. C. Rutherford, Leavenworth, Kan.; Mark A. Cullen, Janesville, Wis.; C. B. Freeman, Cleveland, Ohio; and F. L. Shackelford, Greenville, S. C.

#### Accident Prevention Awards

G. W. Maxon, Dayton, Ohio, presented trophies to winners of the ac-  
(Continued on page 61)

# The Cause of the Sun's Heat

By HALBERT P. GILLETTE

THE cause of the sun's heat received scant consideration until geological evidence had indicated that animals had lived on the earth for many millions of years. They had probably experienced temperatures that were, on the average, about the same as today. Since the source of the heat upon which all life depends is the sun, men began to ask what had been the "fuel" fed into the solar furnace during all those eons. Whence had the energy come? How long would it continue unabated?

Fourteen years ago Jeans said: "The history of science records one solitary attempt to explain the sun's energy as coming in from the outside." As I am about to suggest another outside source of solar energy, the reader may be interested in the one to which Jeans refers.

Robert Mayer, in 1849, suggested that the fall of meteoric matter into the sun might account for its heat. But the bombardment needed to maintain the sun's temperature would double its weight every 30,000,000 years. Geological evidence alone made Mayer's hypothesis untenable.

Four years later Helmholtz advanced his contraction hypothesis; but Kelvin showed that by shrinkage to its present size the sun could have emitted heat only enough to last 50,000,000 years. Geologic evidence of the Earth's age also made this hypothesis untenable.

The discovery in 1900 that disintegration of certain atoms, notably radium, was accompanied by emission of great quantities of heat, led to a variety of hypotheses as to generation of solar heat in that fashion. These were followed by the hypothesis that since all atoms are compounds of hydrogen, there might be enough atomic integration going on in the sun to account for its heat. These two opposing types of hypothesis are still struggling for general acceptance; the one based on atomic disintegration; the other based on atomic integration. Jeans has advanced a very fantastic hypothesis, namely that in the sun electrons (negative units) and protons (positive units) are constantly rushing together, annihilating one another, and converting all their mass into radiant energy.

It is significant that not one of these hypotheses, other than Mayer's, has the slightest observational evidence to support it. Since meteors strike the earth's atmosphere, it is certain that, in vastly greater number, they strike the sun; but that number is probably insufficient to account for the sun's heat. The solar contraction hypothesis is "ad hoc," as the classical logicians would say when they mean that an hypothesis explains nothing save what it was devised to explain. The same is true of all the atomic conversion hypotheses.

In two recent articles I advanced, in barest outline, the hypothesis that the sun is bombarded by high-speed galactic electrons in sufficient numbers to account for its radiant energy. This conception was an unexpected by-product of my electron theory of sunspot and weather cycles. In its earlier form this cycle theory did not take into consideration the possibility that electrons might be moving in great streams throughout the stellar universe. It considered only the evidence that such streams coming from the sun bombard the earth, causing not only auroras and magnetic storms associated with sunspots, but whirls in the earth's atmosphere and other meteorological disturbances. Recently I found that certain annual meteor showers were associated with annual weather disturbances. Upon studying the directions from which meteors come, it was seen that some of the showers had their peaks near midnight, and that consequently these meteors were moving toward the sun. Most of the meteor showers have their peaks near dawn, indicating that meteoric matter moving across the earth's path is struck by the orbitally front face of the earth, very much as a bug flying across a road may be struck by a wind-shield. In 1942 Karl Jansky published his discovery that radio static has a daily sidereal cycle, and that the disturbing effects come from the direction of the zodiacal constellation Sagittarius. It is from that general direction that numerous meteors come in July and August. Then I found that about when the Earth crosses heliocentric longitude 286° (which is not far from the longitude of Sagittarius), there are, on the average, 50 per cent more

sunspots in the daily count than 6 months later. From this I inferred that a broad stream of galactic electrons comes from that direction, and that the Earth's induced magnetic fields tends to focus them toward the sun. In the sun's magnetic field, they would move spirally, according to the Faraday principle of electromagnetic rotation, and carry solar gases with them causing the whirls known as sunspots. If this theory is correct, at least Venus, and possibly little Mars and littler Mercury, would cause increase in the number of daily sunspots when they were near heliocentric longitude 286 degrees. This proved to be the case as to all three of those planets!

It is known that magnetic fields can be used to focus streams of electrons. The electron-microscope is based on that principle. The theory here presented attributes to Nature, on a grand scale, what man has finally found that he can do on a puny scale.

Cosmic rays were discovered in 1909. Compton showed in 1936 that cosmic rays are very high-speed, electrically charged particles having great penetrative power. Later (1941) he concluded that they are protons. The mass of a proton is about 1850 times that of an electron. That electrons predominate in the sun's atmosphere is shown by the spectroscope. That they predominate in the earth's surface has long been known. Their source in the earth has been ascribed to the sun, but their source in the sun has been an outstanding puzzle. It could not be that solar heat is the source, for while heat causes emission of electrons from atoms it leaves behind in the atoms one proton for every electron emitted; and soon no further emission of electrons from the sun could occur because they would be held by electrical attraction between protons and electrons. Only constant destruction of protons in the sun would enable electrons to escape, but there is no experimental evidence that such destruction can occur. When I found evidence that galactic streams of electrons are flowing sunward, it became clear that at least the main source of both solar and terrestrial electrons is those streams. They may carry some protons with them, and these may be the puzzling cosmic ray particles. It is probable that when



galactic electrons enter the earth's atmosphere they pick up protons, or even heavier positively charged ions, and impart the energy to them that gives them their stupendous battering-ram effects.

In any event it is now evident that Eric Doolittle had only an unfounded opinion for a statement made about 20 years ago as to the source of the sun's heat: "The most careful study shows no possibility that it (the sun) can be receiving any considerable part of its energy from any outside source." There has been altogether too much cocksureness among certain astronomers as to what is "impossible" or "unimaginable" in celestial phenomena.

Turning to the face of the sun itself for other evidences of galactic electron bombardment, we have the sunspots themselves. Hale showed in 1908 that they are electrically charged vortices, having powerful magnetic fields. In 1929 I advanced the theory that their rotation is an example of the Faraday principle of rotation of electrical currents in a magnetic field. And I pointed out that paramagnetic gases, notably oxygen, would have magnetism induced in them, which would greatly strengthen the magnetic field of those whirls. Magnetic attraction between electrons moving in the same direction would tend also to prevent disintegration of electron currents by electrical repulsion, and would tend to draw more electrons into such a stream.

Sunspots are often absent. Between 1672 and 1704 none at all were seen in the sun's northern hemisphere. That was near a peak of the 603-year rainfall cycle. But the sun is always covered with brilliant "granules" about 400 to 1,200 miles in diameter. Near sunspot peaks they tend to coalesce into larger patches called "faculae," which later are often replaced by sunspots. I infer that the "granules" are small whirls in solar gases caused by bombarding galactic electrons. Their temperature is higher than in adjacent areas, as shown by the spectroscope, and this I attribute to the impacts of the streams of galactic electrons. Each of these "granules" then would be a magnetic focus attracting galactic electrons. The sun's general magnetic field would then be a resultant of all these minor fields.

I infer that the same sort of explanation applies to the Earth's general magnetic field and the numerous minor magnetic foci in its crust. Bombardment by galactic electrons seems to offer the best solution of the puzzling problem of terrestrial magnetism.

**ROADS AND STREETS, March, 1943**

Because moving electrons are attracted by magnetic poles, and because spirally moving electrons induce such poles in paramagnetic matter, the sun is a gigantic "focus" toward which galactic streams flow. But, as I have indicated in previous articles, the sun is the core of numerous rotating electron-shells, each of which is a compound magnet that also attracts streams of galactic electrons, and tends to focus them toward the sun. Therefore torrents of high-speed galactic electrons constantly bombard the sun, though with cyclic variations in their numbers. After imparting much of their kinetic energy to the sun, they escape with reduced velocity under mutual electrical repulsion. Electron-shells loaded with molecules encase the sun, the planets and the cores of comets, as to which several of my articles have presented evidence.

This theory of solar energy obviously leads to the inference that the sun's surface is as hot as its core, whence it follows that the sun must have a molten core, for under its enormous gravitative pressure there must be a depth at which it ceases to be gaseous and becomes liquid.

The combined electron-shell and electron-stream theory incidentally provides an explanation of comets and of the variable brilliance of certain stars, without any of the prevalent "ad hoc" hypotheses. Indeed, one of the strongest reasons that can be advanced in favor of this theory is that it coordinates many kinds of celestial phenomena that have hitherto had as many different explanations as there are kinds.

#### Further Notes on Ezra B. Whitman, New A.S.C.E. President

When a state highway official gets hoisted to the presidency of such a distinguished body as the American Society of Civil Engineers, it is time that we told fellow road builders some of his background. We're referring to Ezra B. Whitman, recently elected A.S.C.E. head (as noted in the Feb. R. & S.), who since 1939 has been chairman of the Maryland State Roads Commission. Major Whitman, as he has been called by his friends since World War I days, has been virtually a lifelong resident of Baltimore. He did leave the home scene to get his engineering education, and Cornell and the Medical College of New York City, of all places, both claim him as their own. At the latter he did graduate work in bacteriol-



Ezra B. Whitman

ogy and the chemistry of water supply. And there was a youthful experience in the New York consulting firm of Williams and Whitman.

Back in Baltimore, Whitman early became identified with the notable sewer, storm drainage and sewage treatment construction program that followed the great Baltimore fire. After becoming chief engineer and president of the city's Water Board, in 1914 he became associated with the consulting firm of Greiner and Whitman, and in 1916 opened the Baltimore office of Norton, Bird and Whitman, engineers. In the World War, he served as Construction Quartermaster of Camp Meade, and back in civil life continued with his consulting firm, reorganized in 1925 as the present Whitman, Requardt and Smith.

Then more broadening out, including six years with the Maryland Public Service Commission, later as chairman, and service on other commissions in his home state and elsewhere.

#### W. H. Yeager, New County Engineer

Appointment of W. H. Yeager, chief draftsman in the Washington state highway department, as county engineer of Thurston County, Washington, became effective March 1. He was with the highway department for 18 years and was with Thurston County as county engineer from 1913 to 1917. Lt. Col. Clarence Shain, former county engineer, has accepted a post as plans and training officer in the Washington State Guard.



CLETRACS ARE SWINGING IT...



*Against  
the Axis*

UP hill and down vale—through valleys and over mountains, Cletrac power makes hundreds of thousands of swings daily against the Axis.

That's why Cletrac power is fighting power—patriotic power—which deserves every means you have of making it serve as long as possible.

Fortunately, Cletracs have always been "Built to Endure"—not only in use but even with abuse.

However, like all machinery, Cletracs perform better with longer life if you inspect them frequently, lubricate them properly and maintain them carefully by replacing worn parts promptly.

In this conservation of equipment your Cletrac dealer is ready to give you substantial help. Keep your Cletracs swinging it by asking him for his advice and suggestions.

THE CLEVELAND TRACTOR COMPANY • CLEVELAND, OHIO

# Cletrac Crawler Tractors

GASOLINE AND DIESEL



# North Atlantic Conference Looks to Post War Needs

**“W**E must focus on tomorrow's problems today,” was the constantly recurring theme of the 19th annual meeting of the North Atlantic States Highway Officials, held in New York, Feb. 17-19. While the post-war question was given perhaps the most thorough airing of any meeting of the winter, maintenance and other war-time problems were not neglected. The conference's 1,000 registration was only slightly less than that of other years, and interest in the papers and discussions was at a high peak.

## New York City's Forward Plans

With Acting President Herman A. MacDonald (Commissioner, Mass.) presiding, the first session speakers included State Highway Commissioner Schermerhorn of New York, representing Governor Thomas E. Dewey; Theodore G. Morgan, Chairman, Exec. Comm., Canadian Good Roads Assn., and Mayor La Guardia. The Mayor cited the necessity of planning now for a national or even a hemispheric program of highways and making an immediate start on acquisition of rights of way and detailed plans. More complete integration of cities with highway programs was his special plea. The Mayor referred also to the frequent need for elaborate and costly approaches; the Triborough, Washington, Marine Parkway and other bridges in the New York area, whose approaches cost tremendous sums, are living proof of the value of intelligent planning in this respect.

The City of New York is currently engaged in building what will be the world's largest commercial airport. While currently slowed up, this project along with important approach highways is expected to be ready soon after the war. Looking further into New York's place in the post-war world, the city has compiled an after-war construction program (said to involve \$600,000,000) and has appropriated \$30,000,000 for detailed working plans alone.

The second conference session, with Connecticut Commissioner William J. Cox presiding, included a paper on post-war planning by Robert P. Moses, New York Park Commissioner, delivered by James Logan. Moses urged a program which rules out

“We must set our sights higher,” said PRA Commissioner MacDonald in explaining why a number of advance planning projects had been rejected. “We should attempt some of the hard things now—by-passes, city entrances, jobs where right-of-way is a delaying factor . . . projects that will transform blighted city areas into good areas. . . . Building of highways is not an objective but a service to create values that will justify the construction cost.

“I hope we don't go off the deep end and build visionary trans-continental roads, but keep to projects wanted by the normal citizen. Hibernate now? No! Never was there such a time for a scientific attitude toward long-time planning. We must step up maintenance. We must build research organizations that will go far beyond mere testing of materials and develop new processes. We must be ready with leadership and organization and blue-prints.”

long-range academic or visionary schemes but provides for an immediate post-war start on such needed practical projects as the Boston-Washington express highway, together with numerous small projects of the work-relief type. The penalty for failure to provide a few million “planning dollars” now will be a repetition of 1934 days when wasteful types of work-relief were required because no one was ready with blue-prints.

Stanley Adams, Director of Metals and Minerals Division, Office of Civilian Supply, outlined the government's controlled materials plan. He pointed out that the second or current quarter-year of the plan is one of transition, while the third (summer) quarter should see the full plan in operation. He reminded that preference ratings are still in effect for products, in addition to allotment control of materials.

## Contractors in War-Time Maintenance

The contractor's potential usefulness in war-time maintenance and repairs of roads was told by Dwight W. Winkelman, member of Advisory Board, A.G.C. Illinois' \$9,000,000 program of contract repairs in 1942 is an example of the efficient work of this type that road contractors can do under competitive bidding. The 14-year policy of the District of Columbia to let street, alley and sidewalk repairs and maintenance to contract was also noted.

“The country's streets and highways will need a huge volume of extraordinary repairs and maintenance before the war period is over,” said Mr. Winkelman. “While highway officials have concurred on the economy of letting new construction, there is no such uniformity of practice with regard to maintenance, repairs and reconstruction.” Road contractors who were too busy to take part in such work in recent months will be available in increasing numbers now that war construction is tapering off. In spite of depleted equipment and organizations, many contractors have facilities that it would do well for highway departments to make use of. Among the types of jobs for which it is practical to prepare plans and specifications in advance and let to competitive bids, are surface patching, crack and joint filling, weed mowing on shoulders and ditches, bridge painting, furnishing and hauling and spreading of stone materials, building drainage structures. The profit incentive of contract work was said to result in greater efficiency.

R. C. Georger, Director War-Time Transportation, State of New York, listed corrective measures that are now being carried out in some areas and must be pushed with increasing vigor everywhere. These are: (1) Increase passengers carried per vehicle, by curtailment of bus service, fewer stops, use of chartered buses to war plants to reduce private auto





Down to river's edge from the northwest, land of the tall timber, come giant Mack trucks bearing thirty-ton loads of logs ... cut from centuries-old trees for the war needs of today.

## TIME DOES TELL... PLENTY!

The Mack trucks you see on the road today are of all capacities. But there's one thing they have in common. *Being Macks, they're built to last!* That's a basic Mack advantage, doubly important in wartime when replacements are hard to get. Seven of every ten Macks built ten years ago are still on the job. For forty-three years Mack trucks have established a record for long life that is still gaining on home front and battle front alike. The expression "Built like a Mack truck" was not coined by us, but by those who watch Mack trucks at work.

Mack Trucks, Inc., Long Island City, N. Y. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J. Factory branches and dealers in all principal cities for service and parts.



IF YOU'VE GOT A MACK, YOU'RE LUCKY... IF YOU PLAN TO GET ONE, YOU'RE WISE!



# Mack

TRUCKS

FOR EVERY PURPOSE

ONE TON TO FORTY-FIVE TONS

BUY U. S. WAR BONDS

ROADS AND STREETS, March, 1943



travel. Over 80% of all U. S. transportation before the war was by private auto. Only 6% of employees in some war plants today use mass transportation, and this figure must be increased. (2) Stagger plant, office and school hours. (3) Continue to cut down on number of traffic lights, change stop lights to flashers, speed up light cycle time to reduce motor idling (cycle time on many lights can be safely changed from 60 sec. to 45 or 50 sec.).

The third session, under Spencer Miller, Jr., New Jersey Highway Commissioner, was devoted to varied subjects, including "Aerial Surveys for Highway Location," by Wm. H. Meyers, Jr., Vice-President, Aero Service Corporation; "The Highways and Airways," by Gill Robb Wilson, President, National Aeronautic Assoc. and New Jersey Director of Aviation, and "An Appraisal of Our Civil Defense," by Walter D. Binger, Commissioner of Borough Works, Manhattan, and Chairman, National Technological Civil Protection Committee.

#### Thomas H. MacDonald on State Highway Work

Under Chairman Robert M. Rein-dollar, Assistant Chief Engineer, Maryland State Roads Commission, the fourth session was given over to a discussion of wartime state highway problems. Commissioner Thomas H. MacDonald, Public Roads Administration, called state highway departments a key factor in the effort to keep highways going through the war. In summarizing work of the past he pointed out the gradually growing mileage coming under state responsibility, and the large part of normal construction which consists of replacement to correct obsolete, worn or inadequate roadway. Replacement construction must somehow be kept up through the war, since deteriorated roads hasten deterioration of vehicles and tires—a fact often not properly recognized. The seriousness of this fact is shown by a recent survey of selected war industries, in which 73% of 224,000 workers were found to reach their jobs by motor transport.

Mr. MacDonald observed that the state highway departments are best qualified to determine where to put available road materials and manpower to work for the best war-time result. (Many proposed arterial road projects have been questioned by WPB although classed as urgent by the War and Navy departments.) Highway needs are better charted than many other types of proposed war-time activities, thanks to state-wide planning and other surveys

done in the past several years.

Under the present requirement that all projects receive a certificate from a defense agency as essential to the war effort, all material allotments haven't been used. For example, of 25,000 tons of steel allotted by WPB for road projects, only 11,000 tons were involved in jobs that were finally processed for ratings. On the other hand, the \$10,000,000 a month in state road jobs placed under construction last year included much non-essential work from the war emergency standpoint, using critical manpower if not critical materials.

On the subject of bituminous materials, Mr. MacDonald praised the fairness with which the act controlling their use had been administered. Of interest is the increased use of tar over asphalt in the Northeast, to save transportation and capitalize tar's availability. Of 747,000 tons of bituminous materials certified in 1942, 75% was tar. Incidentally, 76% of the quantity of bituminous materials requested was granted.

Pointing to the key importance of maintenance of surface in keeping traffic rolling, Mr. MacDonald voiced the belief that some states should reduce their wheel loads; 18,000 lb. per axle was recommended as a practical maximum. Loadometer check-ups recently show that most truckers are doing a patriotic "full-load" job, 68% of trucks being loaded to capacity. He warned that truckers are kidding themselves as well as overloading the highways by the common practice of 50-100% overloads. Ninety per cent of rated capacity is a safe limit if tires and vehicles are to be conserved.

Speaking further on maintenance, he urged highway departments who have not done so to expand maintenance and repair facilities immediately. Efficient shop foremen are especially needed, and means of attracting and holding them should be provided. Every maintenance employee needs a brushing up on what constitutes good maintenance of equipment today.

On the matter of advancing planning funds, Mr. MacDonald said that PRA has been attempting to hold approval of projects to out-of-ordinary developments, not routine replacements.

A feature of the fourth session was a series of 5-minute discussions of war-time problems by a representative of each of the northeast states.

New York's Assistant Commissioner E. T. Gawkins revealed that his state's post-war plans include an express highway or through-way from the New Jersey line to Albany and to

Buffalo, with an extension contemplated east to New York City. The 200-ft. right-of-way is to be generally on new location, and the plans will provide for a center mall and elimination of cross traffic. The most important sections would be built first, two lanes each way, with a third ultimate lane.

The fifth session, H. O. Schermerhorn, Commissioner, New York, presiding, included a review of road problems by the Association's Executive Secretary-Emeritus, William C. Markham; and a forecast of post-war conditions and how the States should be prepared for them, by G. Donald Kennedy, Vice-President for Highways, Automotive Safety Foundation. Harold J. McKeever, Associate Editor of *ROADS AND STREETS*, presented an informal lantern-slide talk covering his trip over Alcan Highway.

North Atlantic States officers for the coming year are: President, Herman A. MacDonald, Commissioner of Public Works, Commonwealth of Massachusetts, Boston; vice-president, William J. Cox, State Highway Commissioner of Connecticut, Hartford; secretary-treasurer, A. Lee Grover, Secretary, State Highway Department, Trenton, N. J.

#### Willow Run Access Highway, Section 2, Completed

On February 2 traffic began flowing over the limited access highway between Ford's Willow Run bomber plant and Detroit. Called Section 2 of the Detroit Industrial Expressway, this road connects with a recently-completed 2.5-mi. access road, and extends 11.5 mi. toward Detroit.

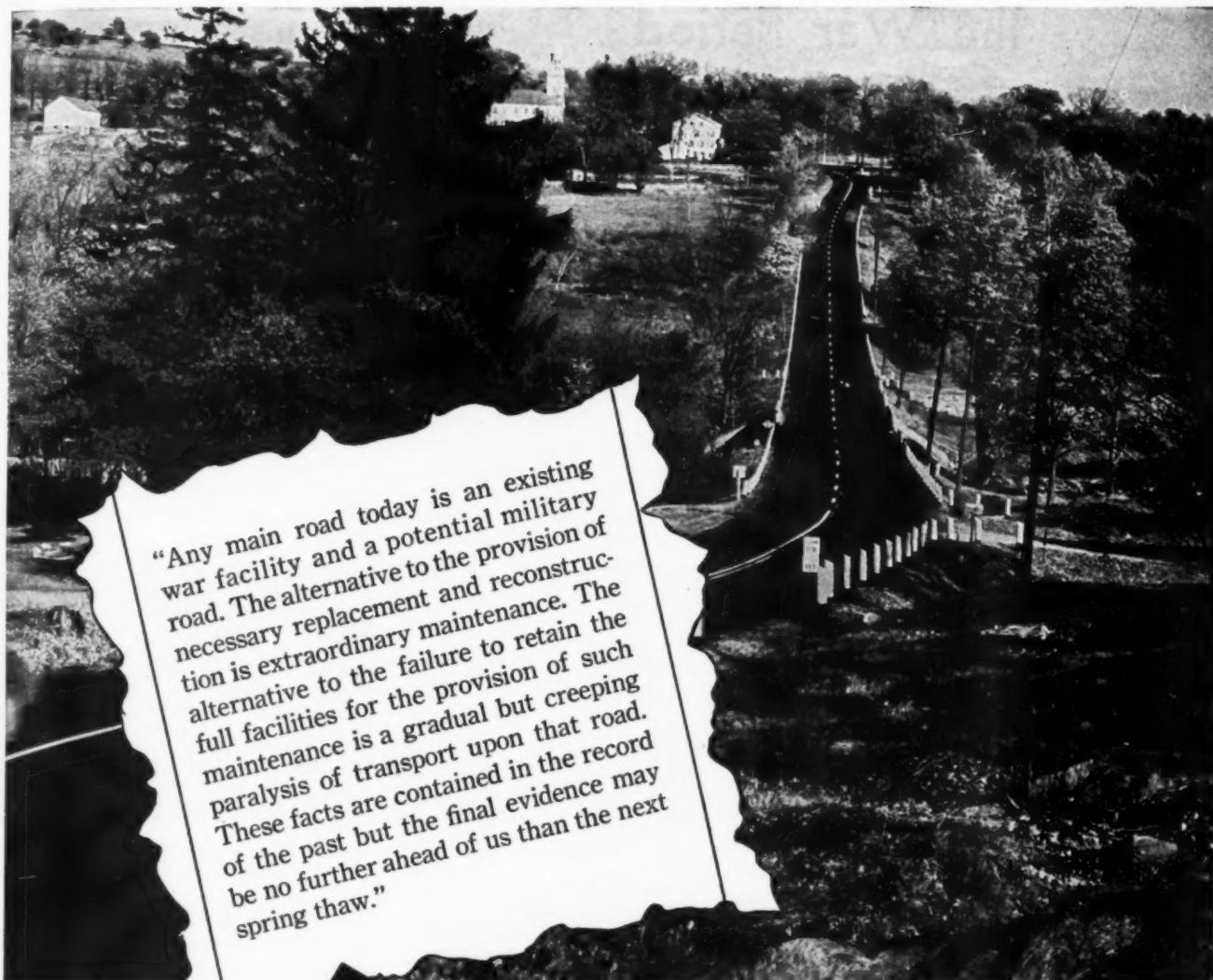
This 4-lane divided-road project is designed for ultimate 100-mph. speeds with maximum safety. Continuous flow of vehicles is insured by 19 grade separations, making it a truly limited access road. Traffic can enter or leave at six points.

The grade separations were built with a saving in cost and steel by the use of new reinforced concrete designs developed by the highway department. About 4,000,000 pounds of steel is said to have been conserved. All steel was eliminated in the concrete pavement design. Construction was speeded through the past winter by intensive use of winter concreting methods.

The road is expected to cut 15 minutes or more from the travel time for many thousands of war workers living in Detroit. It adds 6,000 vehicles-per-hour capacity to the existing 2,500-per-hour capacity of overcrowded roads around Willow Run.

# ATTENTION!

## HIGHWAY OFFICIALS AND ENGINEERS



"Any main road today is an existing war facility and a potential military road. The alternative to the provision of necessary replacement and reconstruction is extraordinary maintenance. The alternative to the failure to retain the full facilities for the provision of such maintenance is a gradual but creeping paralysis of transport upon that road. These facts are contained in the record of the past but the final evidence may be no further ahead of us than the next spring thaw."

THOMAS H. MacDONALD, Commissioner of Public Roads—in *ENGINEERING NEWS-RECORD*

**T**HUS Commissioner MacDonald sums up the vital problem of wartime road maintenance and repair that faces highway officials and engineers today.

Excessive wear to tires and damage to cars are only part of the cost of poor roads. Neglected highways mean delays in transportation of vital food and military supplies, lost man hours by America's industrial workers.

In considering your maintenance problems, remember that there is a right type of Tarvia\* and a right

Tarvia method for almost every type of road maintenance and repair. The Barrett Tarvia field man will be glad to show you the most economical ways to service your district quickly and dependably. He has at his command all Barrett's 37 years of successful paving experience.

Let him suggest how you can keep your roads in the best condition to meet the requirements of a nation at war.

### THE BARRETT DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 RECTOR STREET, NEW YORK

ONE OF AMERICA'S GREAT BASIC BUSINESSES

New York . . Chicago . . Birmingham . . St. Louis . . Detroit . . Philadelphia . . Boston  
Providence . . Rochester . . Minneapolis . . Cleveland . . Columbus . . Toledo . . Youngstown  
Syracuse . . Buffalo . . Cincinnati . . Bethlehem . . Portland, Me. . . Bangor, Me.  
Norwood, N. Y. . . Cromwell, Conn. . . Norwich, Conn. . . Savannah, Ga. . . Norfolk, Va.  
In Canada: THE BARRETT COMPANY, LTD.: Montreal, Toronto, Winnipeg, Vancouver

*Barrett*

\*Reg. U. S. Pat. Off.

# Tarvia\*

ROADS AND STREETS, March, 1943



# Maintaining Michigan Highway and Street Service During the War Period

Highlights from Three Papers Given at the Michigan Highway Conference, University of Michigan, Ann Arbor, February 10-12

## State Phase

BY LLOYD B. REID,

Michigan State Highway Commissioner, Lansing.

**T**HE Michigan Highway Department's current program is concentrated on maintaining the roads needed for heavy hauling of war goods and war workers.

A basic network of 3,000 miles of trunk lines has top priority for main-

considered "expendable" and roadside maintenance other than for preservation of traffic facilities is out of the picture for the duration. Equipment is being used as sparingly as possible.

This year, however, certification is being asked on a 75% federal aid program involving \$1,000,000 in needed access roads, which include new projects or extensions at Ypsilanti, Grand Blanc, Adrian, Traverse City and Fort Custer. Army approval is also to be

gic network is planned, involving \$1,500,000 in federal aid projects held over from last year. Many miles of Michigan state roads are completely worn out, and others are being torn to pieces at an alarming rate by the heavy war traffic. On one road, as an example, concrete pavement broke up so badly under overloads from intensive truck hauling that chunks of uprooted slab had to be carried to the roadside to remove a serious hazard.

Last year about 100 miles of worn-out pavement were given a bituminous covering. This year 300 miles additional are needed, but recapping will be attempted only on about 100 miles. Recapping or entire reconstruction of certain state trunk lines must be continued throughout the war period, and likewise there will be a program of protective maintenance for bituminous sections which would otherwise deteriorate rapidly from too little traffic.

Since we are limited on new construction, emphasis is being shifted



At the Ann Arbor Conference: Leon Belknap, Engineer-Manager, Oakland County Road Commission, Pontiac, talking things over with Michigan State Highway Commissioner, Lloyd B. Reid



Ben O. Jeffs, Commissioner, Missaukee County, and V.P. County Road Assn. of Michigan; R. L. Morrison, Professor of Highway Eng. and Highway Transport, Univ. of Michigan; County Assn. President Geo. W. Koronski (Gogebic County)



Hohn A. Bradley and Luther D. Allen, Commissioners, Oakland County, Mich.

tenance and will continue to get almost as good a grade of maintenance as before. For the balance, only absolutely necessary preventive maintenance of surfaces and drainage lines will be possible. Roadside beauty is

sought on Section 3 of the Detroit Industrial Highway, considered very urgent, and several other access projects.

Reconstruction work on the strate-

to other means of improving the flow of traffic. These include designation of one-way arteries, use of alternate routes to disperse heavy concentrations, and segregation of truck traffic. About 25% of the state's 2,200 arterial traffic lights are being cut off to lessen stops and conserve tires and gas (estimated to save motorists a month's supply of rationed gas).

## County Phase

BY LEON BELKNAP,

Engineer-Manager, Oakland County Road Commission, Pontiac, Michigan.

We do not subscribe to the belief of some that county roads are not essential to the war effort. County road development in Michigan has been handicapped by the inclusion of township roads as a county maintenance burden. Prior to the McNitt Act of 1932, county roads of the state comprised 17,300 miles, but today they include another 67,905 miles of town-

(Continued on page 70)



Bill Kiuvimen, Commissioner, Gogebic County; John Marshall, Commissioner, Benzie County; Frank Reynolds, Chairman Commission, Benzie County



# Texas Road Built by Day Labor With Home-Made Equipment

**N**EARLY a fourth of the nation's military construction program has been concentrated in the Southwest, and paving contractors have been so busy building concrete runways and aprons for Army and Navy airfields that they were not interested in contracts for a mere 9 or 10-mile highway pavement.

The Texas Highway Department has, therefore, had to build badly needed pavements with its own forces; using borrowed, begged or home-manufactured equipment. Results have been surprisingly good, both as to quality and cost. The ingenuity shown in resurrecting discarded machinery, and adapting old parts to new uses, is not only interesting but may inspire the construction of other important projects by similar methods.

Construction of seven miles of 22-ft., two miles of 40-ft., and one mile of 56-ft. concrete slab on State Highway 183, near Fort Worth, is an example. This highway is needed as an access road to the new bomber plant, where several thousand employes go to work daily. It is also a link in the highway which will eventually bypass east and west-bound traffic around Dallas, and will enable the numerous trucks carrying livestock from south and southwest of Fort Worth to reach the stockyards without passing through the main part of the city.

As an access road it carried sufficiently high priority to enable contractors to get materials and needed equipment, but still bids were well beyond the estimates, and the state decided to do the work itself.

The Fort Worth district office is handling the construction. Entirely separate contracting and engineering organizations were set up within this office, with some engineers as superintendent and foremen and some as project engineer and inspectors.

The greatest obstacle which had to be overcome was lack of construction equipment, since the highway department had none. The U. S. Engineers loaned a crane and some other equipment from their "Equipment Pool," because the highway is an access road. A mixer was located in a contractor's yard, where it had stood idle for ten years; was overhauled in the district shops, and is doing good work. The finishing machine was old and discarded, but was rebuilt and is



A home-made subgrading machine. Wheels were turned out on a lathe; cutting blades were pieces of worn-out blades; the frame is plate from a scrapped bridge, welded or bolted together.



The subgrade was trenched at the location for transverse expansion joints, to provide thickened slab-ends in lieu of dowels.



Wheels for the finishing bridge and for the platform which carries curing mats, were made from brake drums to which a plate was welded to form a flange.

working satisfactorily. The batcher bins were rented from a contractor.

Forms were bought wherever a contractor had a few that had been discarded; were hauled to the district shops where they were straightened, and provided with connections and stake pockets when necessary. New

form pins were shaped from used rods off the scrap pile. Scrap rods were also used to make bolts with which some of the other equipment is held together.

The subgrading machine was built in the shops entirely from scrap. Cutting blades are from old grader

blades. The wheels were turned out on the lathe with plates from a scrapped bridge, welded on to form flanges. It is arranged so it can be easily adjusted for depth of cut, and a lever is provided which lifts the blades clear of the subgrade. Transverse and longitudinal members are also plates from a scrapped bridge, welded or bolted together to make them the right length.

The longitudinal center joint is made by a jointing machine, which is rented, but the transverse contraction joints are made by hand by pressing a steel bar into the concrete to form a "dummy" groove. Wheels for the staging, from which the men work who cut these joints, and for the bridge carrying the cotton mats used in curing, were made from old brake drums with bridge plates welded on to form flanges. Tiebars, used across the longitudinal center joint, were cut from sucker rods discarded by the oil industry.

Expansion joints are spaced at 180 ft. and the filler is a 1-in. redwood board. In lieu of dowels across these joints, the slab end is thickened to 9 in.—the same as the outside edges—with a 5 ft. slope from the 9-in. end to the 7-in. thickness of the interior. Subgrading for this thickened end is done by hand, at small cost.

Two small buildings—one for a field laboratory and the other for a field office—were made in sections held together by bolts, so that they can be taken down and stored or set up elsewhere. These bolts were also made by threading both ends of scrap rods.

There is a camp for men, owned and operated by the state, where good meals are served at a cost of 60 cents per day for each man. Kitchen and dining room are on wheels; the sleeping quarters are tents. The men furnish their own bedding, make up their own beds, and keep the sleeping quarters clean. There is no charge for housing. Strict order is maintained, since one carousing inmate would keep all the others from sleeping and the work would suffer next day. This camp is part of the regular maintenance crew equipment and, by keeping living costs down, keeps men from being dissatisfied with nomadic life. A small power plant furnishes light, and there is hot water for lavatories and a shower.

While such a project requires plenty of extra work by an engineering staff badly depleted by the war, it is completing a much needed road at a cost well within the engineering estimate, and everyone is well pleased with results.



Another finishing bridge with brake-drum wheels.



State operated construction camp where men are housed and fed at a cost to them of 60 cents per day. The kitchen and dining room are on wheels. A portable power plant furnishes lights. There is hot water for lavatories and showers. The men furnish their own bedding.



Mixer was an old machine overhauled after standing idle for ten years.

# A Sheave Like This Will Ruin Wire Rope

*Yes, Even..*

HAZARD **LAY-SET**

*Preformed*

Never install a new wire rope on a worn sheave—to do so invites early failure. When the groove gets too wide, it permits the rope to flatten. . . . And don't try to run a new rope over a groove that is too narrow. That pinches the life out of it.

Before installing a wire rope (even the longer-wearing, easier-handling Hazard LAY-SET *Preformed*) carefully check the condition of your sheaves, using the standard sheave groove gauge. For calculating safe groove diameters, the following table gives the exact extent by which the groove diameter should exceed the diameter of the rope:

For ropes of the following diameters in inches	Groove diameter should be greater than rope by not less than the following fraction of an inch	Groove diameter should be greater than rope by not more than the following fraction of an inch
1/4 to 5/16	1/64	1/32
3/8 to 3/4	1/32	1/16
13/16 to 1-1/8	3/64	3/32
1-3/16 to 1-1/2	1/16	1/8
1-9/16 to 2-1/4	3/32	3/16
2-5/16 and larger	1/8	1/4

Save critical steel by careful inspection and proper maintenance of *all* equipment and by using Hazard LAY-SET *Preformed*—the greater dollar value rope. All Hazard ropes made of Improved Plow Steel are identified by the Green Strand.

## HAZARD WIRE ROPE DIVISION

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Fort Worth, Los Angeles  
New York, Philadelphia, Pittsburgh, San Francisco, Tacoma

AMERICAN CHAIN & CABLE COMPANY, INC.

BRIDGEPORT, CONNECTICUT



TOO LARGE



TOO SMALL



PROPER SIZE

HAZARD **LAY-SET** *Preformed* **WIRE ROPE**



# A GOOD MAN WITH BRUTES



Buy 'em, rent 'em, get 'em fixed... he's a good man to depend on when you're in a jam or want to *keep out* of one.

He's the Worthington distributor, the man who handles Blue Brutes — compressors, rock drills, air tools.

If you need a Blue Brute — or several — *fast*... he'll do his darndest to get it to you as soon as possible after you hang up your phone. If your Blue Brutes are facing a stiff schedule, he's the man to send them to for a "physical" — a wise precaution these days when replacements

are hard to get. If rough treatment has turned up bruises or breaks, he's got a "first aid kit" of supply parts and repair "know-how" that will restore their pep and vigor.

They make quite a team. Rugged, easy-breathing Blue Brute Air Compressors with the improved and famous "Feather\* Valve"... easy-handling Blue Brute Rock Drills and Air Tools for a wide range of work... and capable, cooperative Blue Brute Distributors whose job is helping you get *your* job done.

\*Reg. U. S. Pat.

‡Blue Brute Compressors and Air Tools are painted olive drab for the Army and battleship gray for the Navy.

Behind the Fighting Fronts  
with

## BLUE BRUTES

Blue Brutes on the Alaskan highway help punch through the vital life line that will help the U. S. Army smash the Japs! In addition, Blue Brutes are at work today on hundreds of Army, Navy and Air Force projects all over the country — in "uniforms" of olive drab and battleship gray, instead of customary blue.‡

(Nearest distributor is listed on page 61)

Get more **WORTH** from air with **WORTHINGTON**  
**BUY BLUE BRUTES**



Compressors from 60 to 500 cu. ft. capacity in mountings to suit all jobs. Rock Drills and Air Tools that have



always set the pace for easy operation — available in a wide range of weights and sizes.

### WORTHINGTON



Worthington Pump and Machinery Corporation, Harrison, N. J. Holyoke Compressor and Air Tool Department, Holyoke, Massachusetts

He  
Wor  
For  
on BLU  
Rock  
EQ  
ALABAMA  
Birmingham  
ARIZONA  
Phoenix  
ARKANSAS  
Little Rock  
CALIFORNIA  
Los Angeles  
COLORADO  
Boulder  
CONNECTICUT  
Hartford  
GEORGIA  
Atlanta  
ILLINOIS  
Rock Island  
INDIANA  
Indianapolis  
IOWA  
Iowa City  
KENTUCKY  
Louisville  
LOUISIANA  
New Orleans  
MAINE  
Portland  
MARYLAND  
Baltimore  
MASSACHUSETTS  
Boston  
Cambridge  
Springfield  
MICHIGAN  
Detroit  
MINNESOTA  
Minneapolis  
MISSOURI  
St. Louis  
MONTANA  
Butte  
NEW JERSEY  
Irvington  
NEW MEXICO  
Albuquerque  
NEW YORK  
Albany  
Albany  
Mentz  
Buffalo  
Buffalo  
Corona  
Middleton  
New York  
Olean  
Oneonta  
SYRACUSE  
Syracuse  
NORTH  
Durham  
OHIO  
Cleveland  
Marietta  
Toledo  
OKLAHOMA  
Oklahoma City  
OREGON  
Portland  
PENNSYLVANIA  
Easton  
Harrisburg  
Oil City  
Philadelphia  
Pittsburgh  
Wilkes-Barre  
SOUTH  
Columbia  
SOUTH  
Sioux Falls  
TENNESSEE  
Chattanooga  
Knoxville  
Memphis  
TEXAS  
Houston  
San Antonio  
VIRGINIA  
Richmond  
WASHINGTON  
Seattle  
WEST VIRGINIA  
Fairmont  
WISCONSIN  
Eau Claire  
Green Bay  
Madison  
WYOMING  
Cheyenne

## Here Is Your Nearest Worthington Distributor

For Sales, Rentals and Service  
on **BLUE BRUTE** Portable Compressors,  
Rock Drills and Air Tools. Get your  
**EQUIPMENT-SAVER — FREE**

see full page ad page 60

**ALABAMA**  
Birmingham—Tractor & Equipment Co.  
**ARIZONA**  
Phoenix—Smith Booth Usher Company  
**ARKANSAS**—Fort Smith—R. A. Young & Son  
Little Rock—R. A. Young & Son  
**CALIFORNIA**  
Los Angeles—Smith Booth Usher Company  
**COLORADO**  
Boulder—Standard Machine Works  
**CONNECTICUT**  
Hartford—The Holmes-Talcott Company  
**GEORGIA**  
Atlanta—Tractor & Machinery Co., Inc.  
**ILLINOIS**—Chicago—Kennedy-Cochran Co.  
Rock Island—Western Equipment & Supply Co.  
**INDIANA**  
Indianapolis—Reid-Holcomb Company  
**IOWA**—Des Moines—Electrical Eng. & Constr. Co.  
**KENTUCKY**—Harlan—Hall Equipment Sales  
Louisville—Williams Tractor Company  
**LOUISIANA**  
New Orleans—Wm. F. Surgi Equipment Company  
**MAINE**—Ellsworth—Murray Machinery Co.  
**MARYLAND**  
Baltimore—D. C. Elphinstone, Inc.  
**MASSACHUSETTS**  
Boston—P. I. Perkins Company  
Cambridge—W. W. Field & Son, Inc.  
Springfield—The Holmes-Talcott Company  
**MICHIGAN**  
Detroit—W. H. Anderson Company, Inc.  
**MINNESOTA**  
Hibbing—Arrow Equipment & Supply Co.  
Minneapolis—The George T. Ryan Company  
**MISSOURI**  
Kansas City—Machinery & Supplies Company  
St. Louis—Webster & Hedgcock Tr. & Eq. Co.  
**MONTANA**—Helena—Caird Engineering Works  
**NEW JERSEY**  
Irvington—Smith Tractor & Equip. Co., Inc.  
**NEW MEXICO**  
Albuquerque—The Harry Cornelius Company  
**NEW YORK**  
Albany—Larkin Equipment Company  
Albany—T. Southworth Tractor & Machy. Co., Inc.,  
Menands  
Binghamton—MacDougall Equipment Co.  
Buffalo—Dow & Company, Inc.  
Corona, L. I.—The Jaeger-Lembo Machine Corp.  
Middleton—S. T. Randall, Inc.  
New York—Hubbard & Floyd, Inc.  
Olean—Freeborn Equipment Company  
Oneonta—L. P. Butts, Inc.  
Syracuse—Harrod Equipment Company  
**NORTH CAROLINA**  
Durham—Constructors Supply Company, Inc.  
**OHIO**—Cincinnati—The Finn Equipment Company  
Cleveland—Gibson-Stewart Company  
Marietta—Northwest Supply & Equipment Co.  
Toledo—M. W. Kilcorse & Company  
**OKLAHOMA**  
Oklahoma City—Townaco Equipment Co.  
**OREGON**  
Portland—Andrews Equipment Service  
**PENNSYLVANIA**  
Easton—Sears & Bowers  
Harrisburg—N. A. Coulter  
Oil City—Freeborn Equipment Company  
Philadelphia—Metalweld, Inc.  
Pittsburgh—John McC. Latimer Company  
Wilkes-Barre—Ensminger & Company  
**SOUTH CAROLINA**  
Columbia—Bell-Lott Road Machinery Co.  
**SOUTH DAKOTA**  
Sioux Falls—Empire Equipment Co.  
**TENNESSEE**  
Chattanooga—James Supply Company  
Knoxville—Wilson-Weener-Wilkinson Co.  
Memphis—Tri-State Equipment Company  
**TEXAS**—Dallas—Shaw Equipment Company  
Houston—McCall Tractor & Equipment Co.  
San Antonio—Patten Machinery Company  
**VIRGINIA**  
Richmond—Highway Machinery & Supply Co.  
**WASHINGTON**  
Seattle—Star Machinery Company  
Spokane—Andrews Equipment Service  
**WEST VIRGINIA**  
Fairmont—Interstate Engineers & Constructors  
**WISCONSIN**  
Eau Claire—Bradford Machinery Company  
Green Bay—Nelson Machinery Company  
Madison—Western Equipment Company  
**WYOMING**  
Cheyenne—Wilson Equipment & Supply Co.

Get more **WORTH** from air with  
**WORTHINGTON**

**Big Blue Brutes**

Worthington Pump and Machinery Corp.

## Southeastern Association Holds Successful Meeting

A wide variety of urgent problems was covered at the second annual meeting of the Southeastern Association of State Highway officials February 16-17 at Chattanooga. C. W. Phillips, Commissioner Tennessee Highway Department, was elected president for 1943, succeeding Vance Baise, State Highway Engineer of North Carolina. Ernest L. Bailey, of West Virginia, a board member in 1942, is the new vice-president. Berrien W. Davis is secretary-treasurer.

Among the speakers were Brady Gentry, president of the AASHO; C. W. Phillips of Tennessee; and Judge J. Lon Foust, a member of the original Dixie Highway Association founded in 1915. Prof. N. W. Dougherty, Dean of Engineering, University of Tennessee, was the banquet speaker. Louis Levenson, WPB official, urged states and municipalities to pool their equipment for the war period, while Byron N. Scott of WPB talked on the problem of training personnel to replace workers needed in war industries.

Individual meetings, with papers on current and post-war problems, were held by the various committees, including administration; maintenance, equipment and roadside development; road design and construction; bridges; planning and traffic engineering; and right of way.

Typical of the range of topics was that of the maintenance committee sessions which included the following:

"Use of Equipment, Whether to Use the Old Equipment and Save the Best or Vice Versa; Repairing and Reconditioning of Equipment", H. T. Ammerman, Assistant Engineer, Nashville, Tenn.

Discussion Leader, E. L. Worthington, State Maintenance Engineer, West Virginia.

"Purpose of Materials and Supplies, Equipment Parts, Tires, Etc.", Robert King, Purchasing Agent, Columbia, S. C.

"Maintenance of Bridges, Especially Timber; Availability of Good Material—Substitution for Creosoted Material", M. S. Steadman, State Maintenance Engineer, Atlanta, Ga.

Discussion Leader, William A. Kratzert, Maintenance Engineer, Tallahassee, Fla.

"Most Economical Method of Bituminous Surface Maintenance, Whether Gang Maintenance or Patrol Maintenance; Advisability of Resealing in Order to Eliminate Surface Cracks and Excessive Surface Patching", T. V. Fahnestock, Bituminous Engineer, Raleigh, N. C.

Discussion Leader, W. K. Beckham,

Maintenance Engineer, Columbia, S. C.

"What to Do With Concrete Pavements Which Are Failing on Account of Subgrade Condition and Overloading," W. A. Kratzert, Maintenance Engineer, Tallahassee, Fla.

Discussion Leader, T. V. Fahnestock, Bituminous Engineer, Raleigh, N. C.

"Maintenance Organization During the Emergency Period" (this pertains to the patrol method, district floating crews or division methods, number of men, etc.), W. K. Beckham, Maintenance Engineer, Columbia, S. C.

Discussion Leader, J. J. Forrer, Maintenance Engineer, Richmond, Va.

"Use of Prison Labor for Maintenance Purposes During the Emergency", J. J. Forrer, Maintenance Engineer, Richmond, Va.

"Transportation and Safety Problems" (this includes the use of road signs, center-line marking, alternate routes, etc.), E. L. Worthington, Maintenance Engineer, Charleston, W. Va.

Discussion Leader, M. S. Steadman, Maintenance Engineer, Atlanta, Ga.

## A. G. C. Board Meeting

(Continued from Page 48)

cident prevention contests. Trophies and winners were:

Shackelford Trophy in the building division: H. B. Alexander & Son, Harrisburg, Pa. Honorable mention to Vappi & Co., Cambridge, Mass., and W. D. Berry, Inc., St. Petersburg, Fla. Zachry Trophy for highway division: Potomac Construction Co., Martinsburg, W. Va. Honorable mention to DeSalva Construction Co., Cincinnati, Ohio, and Burrell Construction Co., New Kensington, Pa.

In the New England contest, first place was awarded to Vappi & Co. Honorable mention to H. P. Cummings Construction Co., Ware, Mass., and to Carilli Construction Co., Dorchester, Mass.

The award for the outstanding accomplishment in demonstrating to the public the adaptability of construction service to the public need went to Henry J. Kaiser and associates, with honorable mention to those engaged in building the Alcan Highway.

New officers elected to the A. G. C. Secretaries' Council were R. J. Hendershott, Manager, A. G. C. of Minn., chairman; Roy A. MacGregor, Executive Secretary, Constructors Assoc. of W. Pennsylvania, vice chairman; and Frank H. Conner, Acting Executive Secretary, Carolinas Branch, secretary.



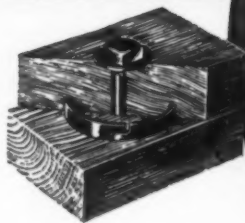
# BIG HAUL

## FOR UNCLE SAM



Selectively cut under scientific woods management, this forest harvest goes to war — leaving the vigorous younger growth for continuous harvests to come. Harvesting matured trees accelerates healthy forest growth.

The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.



# Timber

## ENGINEERING COMPANY

WASHINGTON, D. C.

PORTLAND, OREGON

ROADS AND STREETS, March, 1943

### Wood Goes to War in Many Forms



Crabbe Road Bridge near Tuscaloosa, Ala., designed by Donald A. du Plantier, Associate Professor of Engineering, University of Alabama.

And on the home front, wood has taken over metal's peacetime tasks in thousands of heavy timber structures. This modern bridge, designed with 90-foot spans for an H-15 loading, is an example of how the TECO Timber Connector System has made it possible to employ timber as an engineering material . . . and to meet fully all requirements of speed, strength and economy. Write for literature today.



## 425° Spot Treatment in Wayne County

IN ORDER to conserve materials, equipment and labor, the Wayne County Road Commission has confined work to a 1,970-mile "maintenance system" (see *ROADS AND STREETS*, Feb., 1943, p. 78). It is endeavoring to get by with temporary or spot maintenance wherever possible. As an example of the latter, during 1942 a considerable mileage of the county's bituminous county and township roads were given spot instead of general surface treatment.

For bituminous materials the county has had to relax its specifications at times and take what it could get. According to Wayne County Maintenance Superintendent Milford Brown, ordinarily a rapid curing cut-back is used for a seal coat but this has been supplanted partly by an AC-5 (85 to 100 penetration). This material has served well as a sealer. Many disagree on the use of this heavy a blotter or seal coat, which is too heavy when applied at the customary 300 to 325 degrees. But it works well when applied very hot, about 425 degrees. At this temperature it fuses with the top materials in the old surface (stones in the road can be heard to crackle). One-fourth gallon per sq. yd. is applied, plus all the stone chips the seal will take, followed by quick, thorough rolling with a 7½-ton roller while still hot.

This sealing method has been used on bituminous or bituminous-treated intersections. Holes and depressions are first cold-patched. The chip course consists usually of slag (1/10 to ¼-in. particles) which is rolled into the surface. This application is usually confined to warm, dry weather.

For spot treating sections of bituminous road the seal coat, at 425 degrees, is put down with a hand spray from a distributor, chips applied, and the surface quickly and heavily rolled. If only small isolated patches are involved, trucks heavily loaded with sand have been passed back and forth in place of rolling.

Thirty miles of road in one outlying township were spot treated last fall. "It doesn't have a very good appearance," said Superintendent Brown, "but it got us through the winter with minimum materials and stood up fairly well."

*[Editor's Note: Some operators disapprove of such high heating temperatures as those described in this article. Comments will be welcome from readers who have used them, successfully or otherwise.]*

### Pavement Joints and Cracks

The county's 800 miles of concrete roads, while in generally good condition, include some older sections. Maintenance of joints and cracks is high on the "preventive" list. For filler the county has turned partly from the usual 85-100 penetration materials to a blown asphaltic cement of penetration 46-50. This cement, which comes in handy cartons, is applied with small Duggan push-cart-type crack-filling machines. The special advantage of this unit is that material reaches the pavement very hot, as a result of a jacketed heater tank and two heaters located along the feed pipe, one being at the shoe. The shoe is so hot that the cement is successfully fed into the joint without building up on the surface adjacent to the cracks. The heat of the

roads. This work has gradually eliminated narrow culverts with their dangerous headwalls, and has gone hand in hand with widening shoulders, etc. This winter there is no need to keep such work going on the score of making steady winter employment. Rather, the problem is one of getting men. However, some culverts are being extended with segments of 60, 72 and 84-in. reinforced concrete pipe, using rejects from a large airport project. The pipe is all adequately strong and sound for this purpose, and was purchased at a saving. Head-wall construction is proceeding through the winter, with the usual cold-weather concreting precautions.

### Suburban Driveways

Classed as a service rather than as maintenance, but a maintenance-crew job, is the construction of driveways and drive culverts for homes lying outside corporate limits. Almost the whole of Wayne County is now dotted by such homes. Reflecting the large home building activities, the county



Unit of the type used by Wayne County for crack and joint filling. The county has added a home-made insulating jacket to the 100-gal. tank.

shoe also melts and shears away old extruded joint material from the previous application. Joints are neatly filled with no excess, at a saving of 50% in materials over methods previously used.

By loading these small outfits into light trucks the crews can cover a larger mileage with a two-man crew than five men could formerly do with a much more expensive outfit.

### Culvert Extensions

One of the regular winter tasks of the maintenance force in this county is the placement and extension of culverts, mostly on outlying secondary

installed over seven miles of concrete drain tile for this purpose in 1942. The pipe is sold to the property owner at cost and installed by county as a public service. This work will continue in 1943 as materials and manpower permit.

▼  
The Wisconsin Road Builders Association, at its 30th annual meeting in Milwaukee, elected A. E. Bounsak of Kenosha as president; N. M. Isabella of Madison, vice president; Milo Cape of Racine, treasurer; Claire Pierce of Eau Claire, secretary; Duane Hoffman and J. A. Gallagher, Madison, directors.

# Asphalt Pavement on State Street Chicago

Some Technical Details of the New Surface Laid in 1942

**T**HE Chicago subway, representing the most important municipal engineering project in the history of the city, is rapidly nearing completion and will soon be dedicated for public use by the local transportation authorities. The subway, for a considerable part of its length, lies underneath State Street, from Division Street to Roosevelt Road, a distance of approximately 2½ miles. The repaving of State Street is thus a finishing touch to this ambitious undertaking.

In view of the fact that State Street, prior to the installation of the subway, had been paved with sheet asphalt and had given good satisfaction, it was logical that it should be repaved with the same material.

To those readers not acquainted with Chicago it may be explained that State Street is one of the city's most important thoroughfares. All of the large downtown retail department stores face it, which fact, while attracting many people, also makes for

By VICTOR NICHOLSON

Engineering Chemist  
City of Chicago

heavy vehicular traffic by passenger auto, motor truck, and passenger bus. The corner of State and Madison Streets has been called the busiest corner in the world. An old saying, "All roads lead to State Street," emphasizes its importance as a traffic route. It was considered necessary that the material used in surfacing should embody the following characteristics:

1. Long life.
2. Low maintenance cost.
3. Freedom from vibration, which would be transmitted to the subway and abutting structures.
4. Ease of repairing surface cuts.
5. Freedom from glare.
6. Freedom from abrasive wear, which would result in roughened surfaces.
7. Freedom from cracks or defective joints, which would cause vibra-

tion and shorten the life of pavements.

8. Immunity to the action of alkali salts which occasionally must be used to combat ice formation.

The record of sheet asphalt pavements under heavy traffic in Chicago indicates that the type meets all of these requirements.

The 2½-mile stretch was constructed in four sections, the first two being laid in the year 1941. The section here described is representative of the other three, and extends from Harrison Street to Madison Street. It was laid by the Leininger Construction Co. of Chicago, and completed in September, 1942.

While many articles have appeared in the technical press dealing with such subjects as quality of asphalt, gradation of mineral aggregate, and the design of paving mixtures, comparatively few have dealt with the application of the principles evolved to the manufacture and laying of pavements. It seemed proper, there-



A recent photo of State Street in Chicago's downtown shopping district, showing the clean, modern appearance that means so much to retail merchants.



fore, to the writer to describe in a single article the methods used in the design, manufacture, and application of the sheet asphalt surface on this important street.

### Design of the Pavement

As to general design, the sheet asphalt was placed in two layers—1½ inches of binder and 1½ inches of wearing surface, laid on a standard 3,500-pound concrete base averaging about 7½ inches thick. The subgrade consisted of the original soil with puddled and rolled-in sand or limestone screenings.

The Chicago Standard Sheet Asphalt Specification governed the manufacture and laying of the paving mixture. While these specifications are somewhat narrower in mineral gradation for the sheet asphalt surfacing mixture than those of the Asphalt Institute, they still allow a considerable latitude in choice of mixture. The pavement used on State Street, however, was not an experimental mixture, but represents the gradation, within close limits, used by all the paving agencies in Chicago for new construction work on many streets during the last seven years. These agencies are the Illinois Highway Commission, the Cook County Highway Department, and the City of Chicago.

Mixtures of this type have been used on Harrison Street, Damen Avenue, Archer Avenue, North Avenue, 47th Street, Pulaski Road and others, and have made very satisfactory and smooth riding surfaces.

A laboratory study shows that they all contain an excess of filler in comparison with that required to give maximum stability. Thus they might be considered by some to be an over-filled sheet asphalt. In spite of this condition the finished pavement shows very few flushed spots. It is easily laid, and rolls out to an even contour on the street without any difficulty. Briquettes of the finished paving mixture show a higher stability value than those made in the laboratory study.

The mixing formula for the State Street job was decided upon by the city after an examination and gradation of sands proposed for use and a calculation of the blend of fine and coarse sand required to give the desired gradation in the finished pavement. In the matter of binder composition, the mixing formula was set for a close binder on the basis of the stone aggregate ordinarily delivered under our specifications.

The asphalt cement used had a penetration of 55.

Mixing temperature of the binder was 300 deg. F., and of the sheet asphalt, 360 deg. F.

These mixtures were made in the plant of the Leininger Construction

ing the asphalt from the paving mixtures varies from that ordinarily followed, in that our solvent is a mixture of carbon disulphide, benzol, and denatured alcohol, instead of the

TABLE A  
Sheet Asphalt Mixing Formula

	Per cent
Passing ¼ inch retained on 10 mesh.....	3.00
Passing 10 mesh retained on 40 mesh.....	16.50
Passing 40 mesh retained on 80 mesh.....	28.00
Passing 80 mesh retained on 200 mesh.....	26.40
Passing 200 mesh .....	16.50
Bitumen (Soluble in CS <sub>2</sub> Mixture).....	9.60
Total .....	100.00

Co. at 1101 S. Cicero Avenue, Chicago, about seven and one-half miles distant from the State Street work. This plant is equipped with mechanical devices and appurtenances required in our specifications—mechani-

straight carbon disulphide ordinarily used. The mixture of solvents and method used is that described in volume 12 of the Proceedings of the American Association of Asphalt Technologists, on pages 9 and 10.

TABLE B  
Binder Mixing Formula

	Per cent
Passing 1 inch retained on ½ inch.....	36.00
Passing ½ inch retained on No. 10.....	36.00
Passing No. 10 Sieve.....	23.00
Bitumen (Soluble in CS <sub>2</sub> Mixture).....	5.00
Total .....	100.00

cal proportioners and feeders, recording pyrometers, mechanical timers, and steam jacketed asphalt mixers and weigh buckets.

### Tests and Results

The asphalt cement was a straight Class A. All of the asphalts passed our specifications for this material. The asphalt used on stability study and recovery test of plant mix, described hereafter, tested as follows:

Our specifications require a bitumen content varying not more than 0.25% from the percentage weighed in, and a content of 200-mash materials varying not more than 1.00%. It can be seen by comparing the figures in Table C with the limits set that they meet our requirements very satisfactorily. It should be pointed out here that this uniformity was not attained by the use of excessive mixing time. The timing for both top and binder

	Asphalt used	Specifications
Penetration 100 g. 77 deg. Fahr.....	52	50 to 60
Penetration after 5 hrs. 325 deg. Fahr.....	47	
Loss in Penetration.....	9.62%	25%
Ductility at 77 deg. Fahr., 5 cms./min. cms.....	145	100 plus
Ductility at 32 deg. Fahr., ¼ cm./min. cms.....	5.75	Pen/10 cms.
Viscosity at 275 deg. Fahr. Seconds.....	378	
Fluidity Factor .....	169.5	140 plus
Homogeneity .....	OK	OK
Ash, on ignition.....	0.07%	0.50%
Flash Point deg. Fahr.....	630	535
Solubility in carbon tetrachloride.....	99.39%	99% plus
Specific Gravity .....	1.028	1.02 plus
Sulphur .....	3.82%	3.00% plus

The results shown above are those found on four samples from each of two dumps. Our method for extract-

was 20 seconds dry mixing and 40 seconds wet mixing. The speed of the mixer was 66 r.p.m.

TABLE C  
Test for Uniformity of Sheet Asphalt Surfacing Mixture

	No. 1			No. 2		
	Minimum	Average	Maximum	Minimum	Average	Maximum
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Bitumen .....	9.52	9.56	9.60	9.44	9.52	9.60
200 mesh .....	16.84	16.91	17.00	16.04	16.30	16.48
80 on 200 mesh.....	27.28	27.60	27.80	28.80	28.95	29.24
40 on 80 mesh.....	26.80	27.14	27.84	25.72	26.34	26.84
10 on 40 mesh.....	15.56	15.99	16.32	15.48	15.69	16.00
4 on 10 mesh.....	2.12	2.80	3.63	2.76	3.20	4.30
Total .....		100.00			100.00	



Differing from most specifications, the City of Chicago standard requires that the paving mixture as turned out from the plant be tested for uniformity in composition. In carrying out this test an empty truck is moved under the discharge gate of the asphalt mixer. A single batch of the mixture is made, using the timing decided upon, and dumped into the empty truck. Usually separate samples from four sides of the batch in the truck are taken and tested for uniformity in the laboratory. There is a large divergence from plant to plant in the ability to turn out a uniform batch. In the case of the Leininger plant, however, the uniformity was exceptionally good. Two sets of four samples each were taken and analyzed with results shown in Table C.

It is the opinion of the author that uniformity should be specifically required, since with a non-uniform mixture there is always danger that the street surface may develop waves. Fourteen load samples taken from deliveries of the sheet asphalt surfacing analyzed and graded as shown in Table D.

in the truck, and in only a few cases did it show a thin film of asphalt on its top surface. While the Chicago specifications allow the use of either machine or hand laying, all of State Street was laid by skilled asphalt shovelers and rakers.

The surfacing material as it was unloaded on the steel dump pans stood up in a heap and did not show much inclination to flatten out. While the mixture admittedly was a little heavier to handle than that used throughout the country, it shoveled and raked out nicely.

After rolling, very few honeycombed areas appeared, and there were very few "flushed" spots. It easily rolled to contour, and after rolling and checking with a 10-foot rolling straight edge, required very little extra work to bring the surface to a smooth contour. The straight edge was adjusted to detect irregularities in excess of  $\frac{1}{4}$  inch in 10 feet.

The binder was laid at the rate of 150 pounds per square yard and the surfacing at the rate of 154 pounds per square yard. Rolling was in accordance with the usual standard practice for sheet asphalt. As finished,

they had been run immediately after taking the samples the results very probably would have been even better than they were.

A single load was spot sampled at the plant, and just prior to laying a second sample was removed from the identical spot in load. The elapsed time from leaving the plant until laying was one hour and fifteen minutes. The samples tested out as follows:

#### AVERAGE GRADING OF THE TWO SAMPLES

	Per cent
Bitumen .....	9.68
200 mesh .....	17.24
80 mesh on 200 mesh .....	26.84
40 mesh on 80 mesh .....	28.00
10 mesh on 40 mesh .....	16.40
4 mesh on 10 mesh .....	1.84
Total .....	100.00
Theoretical Density, 2.31.	

#### STABILITY TESTS

	Plant	Street
Specific Gravity of Briq...	2.268	2.256
Voids in Briquette .....	1.82%	1.85%
Stability, pounds .....	1708	1733

The voidage and stability values check very closely from plant to street and compare favorably with the figures I have obtained from mixtures used on Archer Avenue, 47th Street and North Avenue.

The results on the recovered asphalt, using the Abson Recovery method, on the same two samples are given in Table E.

While the loss in penetration and ductility in the asphalt after mixing, to the layman may seem to be considerable, the above figures come well within the limits set in the Michigan State Asphalt Specifications, practically the only governmental body using this requirement. The results compare very favorably with the ideas expressed by Prevost Hubbard and Roland Vokac as found in the Proceedings of the American Association of Asphalt Paving Technologists. They justify the selection of the 50-60 penetration grade instead of the 40-50 grade used on the street a few years ago.

The asphalt plant inspection was performed by Mr. Jas. L. Faulkner, Assistant Engineering Chemist, reporting to the laboratory of the Department of Streets and Electricity. The entire project was under the direction of Mr. Wm. L. Matthews, Engineer in Charge, reporting to Mr. L. M. Johnson, Commissioner of the Department of Streets and Electricity of the City of Chicago.

TABLE D

	Minimum	Maximum	Average	Mixing Formula
Passing $\frac{1}{4}$ retained on 10 mesh .....	2.04	4.24	2.94	3.00
Passing 10 retained on 40 mesh .....	14.60	18.12	16.02	16.50
Passing 40 retained on 80 mesh .....	25.66	29.84	27.18	28.00
Passing 80 retained on 200 mesh .....	25.54	29.60	27.41	26.40
Passing 200 .....	16.32	17.48	16.83	16.50
Bitumen (Soluble in CS <sub>2</sub> mixture) .....	9.40	9.80	9.62	9.60
Total .....			100.00	100.00

It can be seen that these load samples satisfactorily met our test for uniformity in composition and that this requirement is a practical one to include in an asphalt specification.

The mixing formula determined by the city, which is adjustable by the city representative, binds the contractor to deliver the sheet asphalt with a gradation varying not more than the stipulated amount for each mesh size set up in the mixing formula. Except for the bitumen and 200 mesh material, this tolerance is roughly 10% of the various mesh sizes.

The actual mixing of the sheet asphalt surfacing material proceeded in accordance with the requirements of the specifications. Even though the temperatures used were at the upper limits of our specifications the mixture stood up in the truck, and the crater on top of load showed nice cuts or gashes around its rim. Pat tests of the hot mixture never showed more than medium stain.

Arriving on the street, the sheet mixture had lost only about 15 deg. Fahr., had settled down only slightly

the street presents a fine appearance, being smooth, close textured, and without honeycombing. The "flushed" spots have entirely disappeared.

Since completion of the work we have run stability tests and have recovered the asphalt from samples taken on Sept. 5, 1942, to determine the effect of the mixing operation and the time in transit on properties of the asphalt in the pavement. This work, because of the pressure of other duties, was performed about four months after the pavement was laid, on samples stored in the laboratory at air temperatures. These tests are not required in our specifications, and were run as a matter of record. If

TABLE E

	Plant Sample	Street Sample
Original Penetration .....	52	52
Recovered Penetration .....	39	36
Per cent Loss in Penetration .....	25	30.8
Original Ductility cms. 77 deg. F. ....	145 plus	145 plus
Recovered Ductility cms. 77 deg. F. ....	98	81
Original Ductility cms. 32 deg. F. $\frac{1}{4}$ cm. min. ....	5.75	5.75
Recovered Ductility cms. 32 deg. F. $\frac{1}{4}$ cm. min. ....	4.05	3.95
Per cent Loss in Ductility cms. 32 deg F. $\frac{1}{4}$ cm. min. ....	29.5	31.3
Melting Point, degrees Fahr. ....	139.5	140.9
Per cent Ash .....	0.19	0.16

# Built 1921—Rebuilt 1941

Progress Made in Design and Construction During Past  
20 Years as Indicated by Records of an Iowa Highway

**T**HE Soldier and Little Sioux River Valleys in Monona County, Iowa, are separated by a range of hills that are as rugged and beautiful as may be found in the state. The traffic count, listed below, indicates the road connecting the Town of Soldier, at the east end, with the town of Turin, on the Sioux, is just another road. But to the local people, and the engineers who built this road in 1921 and rebuilt it in 1941, it is a big little highway.

Both projects were under the super-

By **EARL CAPEL**  
District Engineer,  
Iowa State Highway Commission

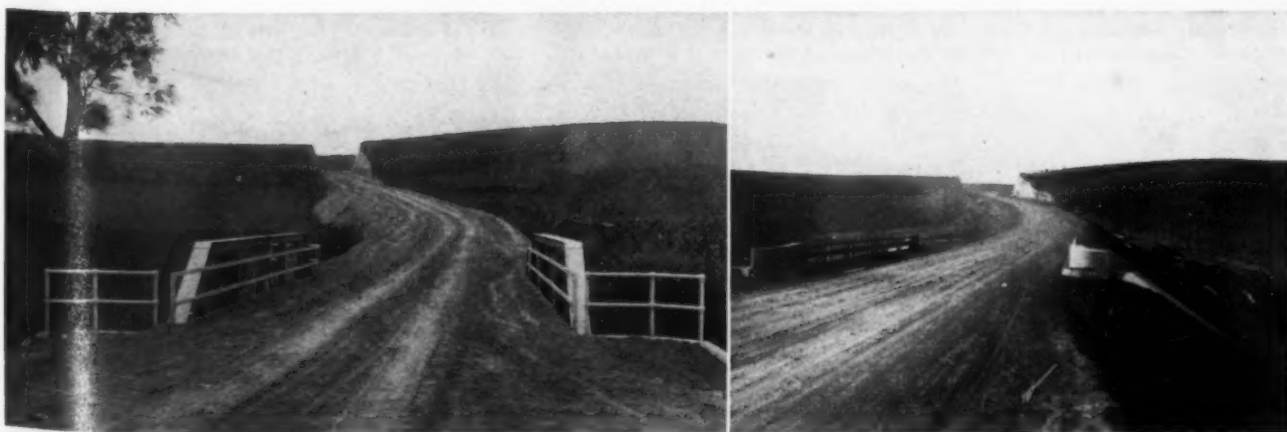
vision of the same engineers associated with the state highway commission. This accounts for the rather complete photographic and cost record of the 1921 and 1941 construction. The photographs are the best evidence of the trend of the designers to provide bridges with wider roadways, more vertical clearance for ice and flood water, and a greater water-

way. The truss is giving way to the continuous I-Beam or girder.

The drop inlet on culverts has been streamlined, but it was constructed only where an old structure is to be used in place. The broken back culvert and the drop inlet, as a means of taking water to a lower elevation, has been replaced by a culvert, with a near level flow line, built up on the side of the ravine. A concrete flume conducts the water from the outlet of the culvert to the flow line of the stream.



Same church, same road, wider section and flatter curves



New superstructure on old abutments. I-Beams replace steel truss

ROADS AND STREETS, March, 1943



Drop inlets were replaced by flumes. If the down stream land owner does erosion control work, and causes the stream to fill, he will not damage the structure



Flood water is held between the dikes along the Maple River at an elevation above the surface of the adjacent fields. Ice does not escape from the main channel, but floats down to the first low bridge and then becomes a part of a jam that may extend upstream in the drainage ditch for miles. This justifies building the bridge at the right at a cost of \$25,517.00 in place of the ice catcher at the left that cost \$8640.00



Where the old culvert was used, drop inlet was added to upstream end, to aid in battle against erosion. Structure on left was built in 1921





The structure, over Beaver Creek, costing \$6500.00 in 1917, was replaced by a continuous I-Beam costing \$29,783.00. Note the battered tubes under the old structure. These were not built this way. Unstable soil gave considerable trouble here



Power scrapers hauled earth for as low as 6.7 ct. per cubic yard. Overhaul was 1 ct. per station yard with 1000 foot free haul. The 1921 price was as high as 19.25 ct. This was a low figure in that year

Alignment has been improved by reducing the number of curves. Long verticals increase the sight distance. The roadway of the earth section has been increased from 26 ft. to 36 ft. Twenty years ago the back slopes were not slopes. They were built vertical in the loess soil. Later they were rebuilt in a few cuts, to  $\frac{1}{2}$  to 1. The walls of the cuts were but 38 feet apart. In 1941 the back slopes were built  $\frac{1}{2}$  to 1. They are 76 feet toe to toe of slope.

The roadway was surfaced with gravel after 1921. 1941 plans provide for a stabilized base with bituminous surface.

The records indicating the trend in the last twenty years are contained in Table I.

These records indicate the progress made in road and bridge design for the roads of average traffic. The improvement in earth moving equipment has brought about a reduced cost in earth excavation. But bridge and culvert prices have increased during the past twenty years.

Year 1921		Year 1941	
Daily traffic, east of Turin			
Trucks .....	2	Trucks and busses.....	91
Tractors .....	1	Cars .....	630
Cars .....	76		
Horse drawn .....	29	Total .....	721
Total .....	108		
235,921 Cu. Yd. @ 18.6c		Earth Excavation	
		649,697 Cu. Yd. @ 7.2c	
2c per station yard, 500 ft. free		Overhaul	
		1c per station yard, 1000 ft. free	
Bridges			
Concrete, including steel and excavation, per Cu. Yd.....	\$22.00		\$33.00
Structural Steel, in place.....	.07		.065
Foundation pile, in place.....	.50		.85
Note: Reinforcing steel and excavation were separate contract items in the 1941 contracts but are included in the above prices for concrete.			
Concrete, per cu. yd.....		Culverts	
\$16.90		\$20.57	
Total of 51 curves		Alignment	
Two curves of 40 degrees		Total of 20 curves	
400 feet		One 5 degree curve is the maximum	
Sight distance at hill tops		800 feet	

Methods of bridge building and equipment used on bridge construction have not improved along with equipment and methods used on paving and earth moving operations. Perhaps this is because there was more room for improvement in the

operations that have shown the most progress.

Prior to 1921, bridge building was the major concern of the highway engineer and contractor. Since then more time has been given to earth moving and paving.



The camera was held in about the same position for the above photos. The cut at the left is not as deep by three feet as the cut at the right. The cut on the right is almost twice as wide as the one built in 1921. The vertical curve extends into the 1941 cut on the right to provide greater sight distance

ship roads and subdivision streets outside of municipalities. These roads—little improved and hence not economical of maintenance—must be maintained by a \$4,000,000 annual allotment which provides only \$59 per mile. The result has been a serious curtailment of county road maintenance, both trunk and secondary.

The serious problem of how to keep up war-essential roads was brought to focus by the severe January snow storms in southern Michigan. Many miles of Oakland County's 2,427 miles of roads and streets were blocked—some subdivision and local roadways for 3 to 5 days, isolating war defense workers. Over 500 distress phone calls a day gives a hint of the thousands of man-days lost to war plants. Two large plants in Pontiac, manufacturing equipment and supplies for our forces, lost 33,076 man-hours during that week. From 40 to 50% of these men lived outside the city. A similar situation exists in other areas, where further reduction of county road forces and equipment would play still greater havoc with war industries. It is our humble opinion that employees in county road work are absolutely essential to the war effort, that highways are just as essential as other transportation or communication facilities.

A rapid decline in motor revenues is being presented through gas rationing, share-the-ride plans, and other measures which prolong the life of motor cars and rubber tires. This was proved during 1942 when Michigan weight tax receipts amounted to \$22,680,307 as compared to \$23,879,370 in 1941 or a total reduction of only about 5%. The reduction in gas revenues was approximately 11% in the period.

There has been very little replacement of old or worn out equipment in the past year. This necessitates a very careful plan of preventive maintenance to keep equipment rolling. To replace truck equipment alone in Oakland County normally requires the purchase of 8 to 10 trucks yearly to keep this equipment within a 12-year age limit. Available equipment is being used longer hours.

Substitutes must be found for many of the critical materials now used in highway maintenance. We'll have to use less of:

Alloy iron, aluminum, brass, bronze, copper, wrought iron, alloy steel, steel plates, structural steel and piling, wire rope, wire products, rails and reinforcing steel, pipe, burlap, manila fiber hemp, sisal hemp, all structural grades of lumber and many other grades and kinds, tung oil, pig or hog bristles and rubber.

And more of these items, available except for restrictions in labor, trans-

portation or manufacturing difficulties:

Lead, muriatic acid, short fiber asbestos, asphalt, brick, portland cement, coal for pitch, lead pigment, various grades of lumber and mill work, paper, paperboard and plywood.

Roads should be studied and classified to determine those which should receive the most attention. A general order of priority should be established. There must be a reduction in dragging or scraping of earth or gravel roads, mowing of weeds and brush, snow plowing on certain roads, painting of signs, traffic lanes, etc. Maintenance operations should not be reduced to such an extent as to cause irreparable damage to the traveled surface and drainage structures.

### City Phase

BY GEORGE H. SANDENBURGH,  
City Engineer, Ann Arbor, Michigan.

Perhaps the most interesting fact about our wartime street traffic is that it has grown in over-all volume rather than decreased. This is due to the influx of war workers in Southeastern Michigan. In spite of gas rationing, Ann Arbor's streets are heavily taxed.

A further complication is the increase in parking. Every worker has a car, and due to the shortage in garage space, all-night parking especially has greatly increased. Share-the-ride driving means that a good many cars are left at home in front of the house. Since car owners take turns, the pattern of parked cars constantly changes. We have always had the all-night parking problem in the business district, and the attendant difficulty of street cleaning and snow removal. War conditions have spread this problem to the residence districts and greatly complicated snow removal.

More attention was given this past winter to ice control, since 24-hour war plant operation creates almost as much traffic at night as in daytime. We have seen that all hills, stop-light approaches and curves are well sanded. Our street crews worked night and day for weeks at a time.

### Street Snow Removal

In spite of the severest winter in 34 years, we have been able to clear all of our 100 miles of streets within two days after a storm. Ann Arbor's equipment includes four trucks with undertruck scrapers, one truck with front-end plow, and two large motor graders. Up to the present we have been able to secure repair parts under L-158.

The question of discontinuing snow removal from residence streets, to conserve gasoline, tires and equipment was raised, but we think it more

in the interest of the war effort to help save these items on thousands of workers' cars rather than ten pieces of equipment.

### Street Surface Maintenance

Our low cost pavements ordinarily are resurfaced about every six years, this being more economical than letting them go longer and doing spot patching. The severe winter is expected to bring more break-up than normal, consequently some spot patching will be necessary. In the past, patch materials such as Amiesite, Wesphalt and Michigan specification CP-1 have been stockpiled all winter. This year rock asphalt is a possibility, since available without a certificate of necessity, although shipment cost is higher.

A serious condition would arise if municipalities were unable to obtain bituminous materials for pavement maintenance and repair. I know of no other material that could be used as a substitute in maintenance and repair. They are used universally for patching all types of pavements—concrete and brick, as well as bituminous.

Michigan's street maintenance problem is the more serious when you consider that there are about 13,500 miles of city streets within the state, of which 8,206 are unpaved, and that about 54% of all peacetime motor vehicle travel in the state is on city streets.

### Michigan Post-War Planning

Michigan's highway planning for the post-war period was far advanced before the war began, according to C. W. Lucas, Director, War Activities Division. A master plan for the ultimate improvement of the entire state system based on highway planning survey and subsequent findings was approaching completion in 1941.

Coincidentally, studies had been undertaken and plans had been developed for a major transportation improvement program in the city of Detroit.

On the basis of today's facts and estimates, Michigan's ultimate system will be comprised of 2,624 miles of multi-lane, 3,761 miles of major type, two-lane, 3,059 miles of minor type, two-lane highways. Routes connecting Detroit with Toledo, Chicago, Flint and Mt. Clemens will be of the highest type of design.

The essential features of the plan developed for Detroit are roadways of highly specialized design affording safe, fast, unobstructed movement on principal routes of travel.

Its key component is the Detroit Industrial Expressway (see p. 54).



# Equipment Maintenance

## How Eastern Equipment Distributor Is Aiding War Program

With Notes on an Interesting Shovel Overhaul Job

By HAROLD J. McKEEVER

Associate Editor, Roads and Streets

THE important role of the construction equipment distributor in the war program is shown by the recent work of H. O. Penn Machinery Company, Inc., of New York City. This firm, one of the largest in the business, has been able to render valuable service because of several factors. One is its facilities for rounding up large quantities of machinery in a hurry. It has helped the Army and Navy outfit off-shore base construction jobs from the Arctic to the tropics, and has expedited much harbor and dock work as well as airports and other big jobs along the eastern seaboard. H. O. Penn Machinery Co.'s customers, normally road contractors, highway departments and municipalities, since the war have included the Corps of Engineers, the Bureau of Yards and Docks,



H. O. Penn

Army Ordnance, and war contractors. Road building machines are helping fight this war!

Another war-time asset of this organization has been its trained personnel. Penn has been unusually successful in holding his organization, and has dispatched service men to distant bases to help set up parts and servicing facilities and advise at times on the types of units needed for equipment layouts. His men have assisted in making surveys to determine the quantities of parts necessary for these off-shore jobs.

A third asset is the facilities for processing or supplying parts in short order and in large volume. Before Pearl Harbor as a bit of foresight this firm, which ordinarily carried about \$30,000 in parts, began building up its parts inventory until

General view of H. O. Penn's busy main shop along the East River in New York





## Equipment Maintenance



Before and after building up the lugs on a Bucyrus-Erie 52-B shovel's track pads. Left shows worn lugs. Right shows lugs after restoration. Several tons of metal saved by this welding and grinding operation which salvaged 56 pads

about \$150,000 is now maintained. More recently, factory-made parts have been conserved and the parts shortage met by a program of salvaging worn or broken parts whenever feasible.

Fourth, is the job of renovating equipment and putting it in good-as-new condition for tackling new war jobs. This company has overhauled

much government equipment as well as machines of its own. This work is done mainly in the big 30,000 sq. ft. shop out along the East River in New York, where 35 mechanics have been working nine hours a day, six days a week. Ten men are kept on duty, likewise, at each of the two branch shops at Mineola, L. I., and at Poughkeepsie, N. Y. This compact

shop organization cracks out a large volume of work under the policy of farming some of its special work out to welding and other nearby shops.

Service men are frequently called on to service fleets of 5 to 25 earth-moving units, located in out-of-the-way places where no other trained construction machinery mechanics are available.

H. O. Penn Machinery Co.'s main shop is equipped to repair or rebuild all types of shovels and cranes up to 2½ yd., tractors, pavers, mixers, motor graders, road rollers, pumps, compressors and smaller units. A special department of the firm is devoted to diesel engines and generator sets. This type of equipment has been important in connection with asphalt plants, quarrying and aggregate production at off-shore bases, and for the flood-lighting that is needed in every case.

### Tricks in Overhauling a Shovel

Overhauling is a different story compared with a couple of years ago. As an example, take the case of the 52-B Bucyrus-Erie 2½-yd. shovel just overhauled this February. Here are some of the things that were done to get this job out and conserve metal and parts (see photos):

### Track Pads Salvaged

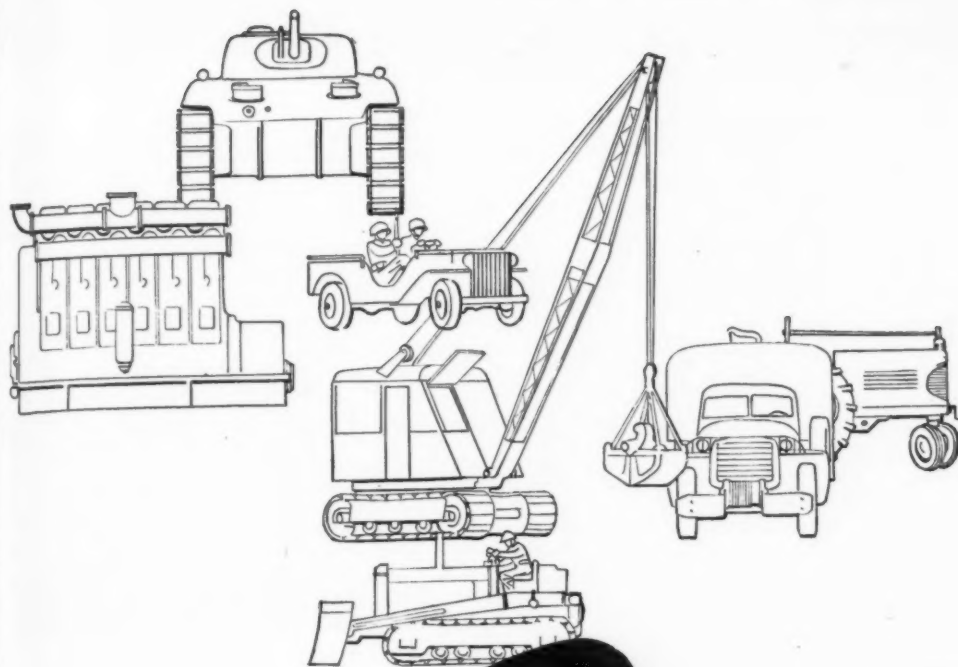
Badly worn track pads were salvaged and re-used 100%. A local



Shovel crawler wheel shown after worn rim has been burned away, breaks in wheel sectors welded, and new home-made rim and rim washer placed in position for welding



Shovel crawler wheel after the welder has finished. Note the neat bead around the inside of the rim, well-built-up welds at flange points



Announcing

# GULF Dieselube H.D.

New detergent type lubricating oil for heavy-duty service

High detergent action and lubricating value of Gulf Dieselube H.D. insure minimum ring sticking, minimum engine deposits and maximum protection against wear.

Years of exhaustive research by Gulf technologists have produced an improved lubricating oil of the detergent type—Gulf Dieselube H.D. (heavy duty).

Gulf Dieselube H.D. meets U. S. Army specification 2-104A for use in automotive gasoline and Diesel engines and has been approved by manufactures of Diesel engines for tractors and trucks. This quality detergent oil is now used for lubrication of tanks produced by several leading builders.

Severe heavy-duty Diesel engine tests conducted by Gulf Research Laboratories show Dieselube H. D. keeps engines remarkably clean and gives maximum freedom from ring sticking.

This new oil is recommended for use in bus, truck, tractor, marine, and industrial Diesel installations, as well as for other Diesel engines where manufacturers

recommend or operators desire a detergent type oil of the highest quality which is noncorrosive to alloy bearings.

Gulf Dieselube H.D. is also recommended for gasoline engines in commercial equipment where service encountered is extremely heavy and where ring sticking or lacquer formation has been encountered with previous oils.

For further information on Gulf Dieselube H.D., send the coupon below.



**MAIL THIS  
COUPON TODAY**



Gulf Oil Corporation • Gulf Refining Company  
3800 Gulf Building, Pittsburgh, Pa.

RS

Please send me, without obligation, further information about Gulf Dieselube H.D.

Company.....

Name.....

Title.....

Address.....

**GULF OIL CORPORATION • GULF REFINING COMPANY • PITTSBURGH, PA.**

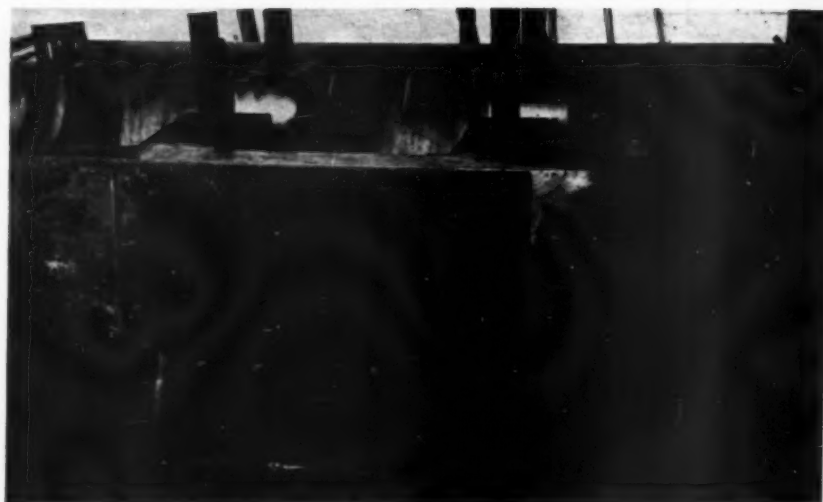
**ROADS AND STREETS, March, 1943**

welding shop helped on this. First, bent-over corners of badly chewed lugs were trimmed away with the torch. Then the lugs were built up by laying beads with soft  $\frac{1}{4}$ -in. rod and finishing off with hard rod. Surfaces were ground to original shape with portable grinders. Fifty-six pads at 300 lb. each adds up to nearly nine tons of parts salvaged.

#### Crawler Wheels Rebuilt

Crawler wheels, nearly all badly worn, with segments cracked from severe usage, were completely rebuilt, as follows:

1. Worn rims were burned off, using a cutting machine to get a true cutting circle. Radius of the cut was of necessity about  $\frac{1}{2}$  in. less than the inside radius of the rim.
2. Cracks in the wheel sectors were welded, and broken-out areas were restored by welding in pieces of metal.
3. New rims were made in a local steel shop, by bending pieces of bar steel to a circle and welding the joints. Rims were brought to an accurate circle by flattening them slightly as needed in a hydraulic press.
4. Rims were then set in place over the old wheels, and the  $\frac{1}{2}$ -in. clearance space filled by inserting an inner rim or hoop, driven into place with a mallet.
5. Then the entire assembly was welded by laying a weld line completely around the inside of the rim. The weld was built up until the inner hoop was entirely covered, and an extra thickness of weld was placed where the wheel flanges met the rim.
6. Worn bushings were chiseled out and replaced with bushings cast



These two views show the inner copper plate and outer steel plate used to repair a jagged hole in the crankcase of a 200-h.p. Atlas-Imperial diesel shovel engine. Note also the inset, soldered copper plate in the gasket bed



Bucyrus-Erie 52-B drive sprocket waiting to have worn lug surfaces built up by the H. O. Penn welding crew

locally and machined in the firm's shop. New bushings were made under-size as needed to fit worn shafts.

#### Some Other Details of This Overhaul

Crawler drive sprocket teeth were also built up with the welder and ground to shape.

The horizontal swing shaft was salvaged by building up with welding, machining and re-threading. (This shaft had been repaired temporarily in the field when threads had stripped, by welding the clutch-adjusting nuts to the shaft.)

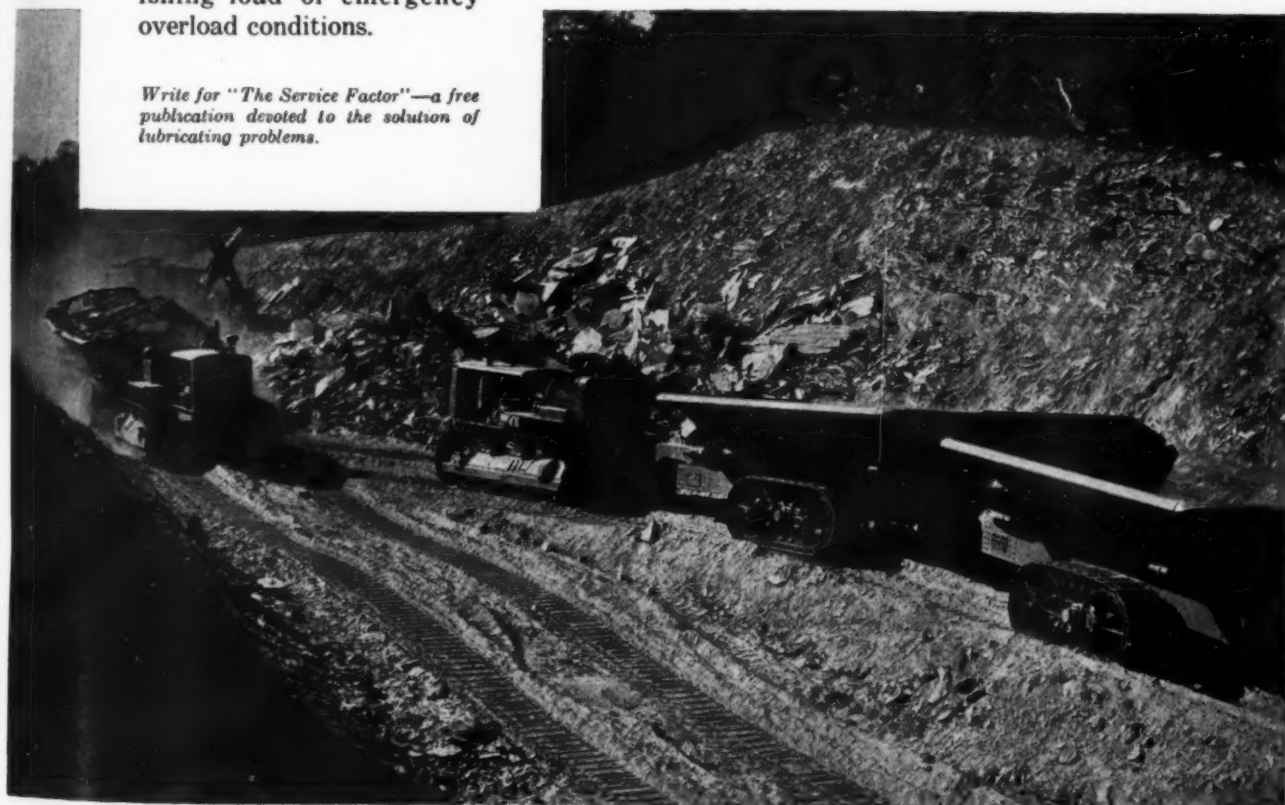
Several bevel gears, badly worn, were built up with the torch. In some cases mashed gear teeth were simply ground as nearly as possible to the original shape using a portable



**GUN POWER** needs manpower — and machine power. To keep **CONSTRUCTION** equipment meeting today's stepped-up program use . . .

**.....SINCLAIR  
SPECIALIZED OILS  
and GREASES.** These lubricants are designed to keep machinery giving top yield . . . continuous service hours under the most punishing load or emergency overload conditions.

*Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.*



# SINCLAIR LUBRICANTS-FUELS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2340 WEST CERMACK ROAD  
CHICAGO

10 WEST 51ST STREET  
NEW YORK CITY

RIALTO BLDG.  
KANSAS CITY

573 WEST PEACHTREE STREET  
ATLANTA

FAIR BUILDING  
FT. WORTH

ROADS AND STREETS, March, 1943

## Equipment Maintenance



(Left): New exhaust line for Bucyrus-Erie shovel was manufactured by assembling a piece of flexible metal hose and machining pipe coupling to fit. (Right): Two worn teeth in one of the 52-B's gear were raised with welding metal and ground with a portable electric grinder.



The hydraulic track press is kept busy these days. Worn tractor track parts are salvaged to the limit

ROADS AND STREETS, March, 1943

grinder, without building on any metal.

### Unusual Repair of Engine Bed

One of the most interesting details of this overhaul job was the way the Penn shop men repaired a break in the heavy engine crank-case casting. This shovel's engine is a 200-horse Atlas-Imperial diesel. Apparently what had precipitated the overhaul was the event of a connecting rod going through the case. Since local application of heat might warp this engine's long bed casting, and ruin the bearing alignment, the jagged 2-ft.-wide hole in the case was simply covered up. On the inside, a thin piece of copper was laid over the break and fastened down with brass screws. On the outside, a piece of steel plate was placed, this being held by hardened bolts tapped into holes drilled in the casting. The break took out about ten inches of the gasket bed. A piece of copper plate was inset into the bed area and soldered with 50-50 solder.

### Other Recent Conservation Tricks

The firm's new metal spray equipment opens up the salvage and rebuilding of parts never before dreamed possible. Today, when a crankshaft, for example, is worn due to long usage it goes through a "face-lifting" process.

Clutch plates, which were formerly replaced, are today surface ground and go back for another period of wear.

Tractor sprockets, which wear



Scene in H. O. Penn's closed-off room which houses delicate equipment for adjusting and testing diesel injector nozzles

faster than the hubs, are now repaired by cutting off the spokes at the rim. New rims with teeth are then welded to the old hub. Special tools are available for cutting the spokes uniformly, using the hub as the axis. Here again is a definite saving of materials and time.

Recently, a nearby shipyard faced the danger of a complete shut-down due to the failure of a crane vital to the movement of much material in the yard. The hollow-center shaft had broken, and the best time available for delivery of a new part was three months. By welding in a new



Wilmot Sandham, Penn's Service Manager

section, cutting new outside splines and drilling the center, the H. O. Penn service crew had the crane back on the job in three days.

#### Penn's Shop Equipment

In spite of the policy of using outside shops at times, the Penn shop

at New York is well equipped for almost any kind of work. Shop units include a 300-amp. electric welder, acetylene outfit, stationary and portable grinders, power hacksaw, hydraulic press, medium-sized lathe, drill press, valve refacer, valve re-seating grinders, overhead crane, several heavy-duty hoists, small forge, hydraulic track press, the usual greasing equipment, and an unusually well equipped tool room. Also an enclosed, ventilated diesel injector test room, complete with the delicate precision apparatus required for this purpose. The metallizing unit is a recent addition.

The H. O. Penn Machinery Company was founded some twenty years ago by the man whose name it bears, today its president. J. A. Frost is vice-president; Ralph L. Johnson, secretary; Miss H. Plotkin, treasurer. Service manager is Wilmot Sandham, with Joseph Klingel shop foreman in New York, Wm. DuBois at Mineola, and Godfrey Berger at Poughkeepsie.

#### Knetsch New Texas Commissioner

Fred E. Knetsch has been appointed commissioner of the Texas highway department, succeeding Robert L. Bobbitt. The event of "swearing" him in was notable in that it was done in the department offices with the highway organization witnessing the ceremony. Mr. Knetsch is from Seguin, Texas, and is a past-president of the Texas Elks Association and chairman of the Elks Foundation for crippled children.

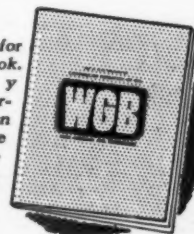


## WGB

**Removes Grit and Water  
Without Affecting Modern  
Oils**

Many of today's best oils contain detergents to keep varnish from forming. Many of today's oil filters remove these additives. But not W.G.B. The big fibre cartridge in W.G.B. Clarifiers removes grit, water, and colloidal carbon, leaving the oil amber-clear with all its protective properties. Refills are cheaper than oil changes and are made quickly and without tools. Specify W.G.B. for a sturdy, simple proved clarifier which saves time, money, oil, overhauls, and irreplaceable engine parts.

Write today for this free book. See why W.G.B. Clarification pays. See correct models for gas and Diesel engines.



## WGB

**OIL CLARIFIER, INC.  
KINGSTON, N. Y.**



## All Work and No Care Makes a Dull Jack

By F. J. JAKOUBEK

Chief Engineer, Templeton, Kenly & Co.,  
Chicago, Illinois

**F**EW tools receive more rough handling and frictional wear than jacks. Any jack worthy of the name is a tough machine, but no jack is immune to abuse, as some users seem to think. We have had jacks returned for repairs after years of service that had never seen an oil can. A good grade of grease or oil, as indicated, should be applied to all bearing surfaces, as needed. It should be borne in mind that proper lubrication reduces frictional losses and minimizes the effort required to operate the jacks under load.

### Guard Against Overloading

But there are even worse sins committed in the name of leverage. Overloading is one. Simplex Jacks are tested for a 50% overload, but that doesn't mean a 50-ton jack should be used to lift 75 tons. That 50% overload is a safety factor.

### Do Not Allow Jacks to Become Fouled

Another bad practice is to allow the operating mechanism or rack bar of lever jacks to become fouled with dirt. Dirt should be blown out or, if necessary, the jack washed in kerosene. The operating mechanism on trip or track jacks is, of course, exposed and there is more chance for the entrance of debris. There is less danger with jacks of the non-tripping or automatic lowering jacks, which must be jacked down, as they have cover plates over the operating mechanism. In either case, however, keep socket pawl seat clean, and keep rack teeth clean so pawls can engage fully. (See Fig. 1)

In the case of the screw jack, in its

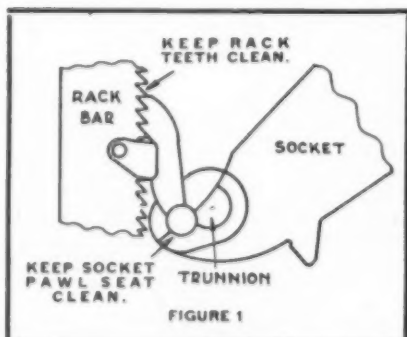


FIGURE 1

various forms such as the regular bell bottom screw jack, locomotive screw jack, the journal jack, standard speed jack, push-pull jack, shoring jack, machinist's jack, trench brace and mine roof jack, care should be taken to keep the screws clean and well lubricated. Continued exposure to grit and dirt causes abrasion of the screw, wearing the threads so that play develops between it and the corresponding collar threads. (See Fig. 2)

A Rochester, Minn., contractor, who uses a pair of screw jacks to take the

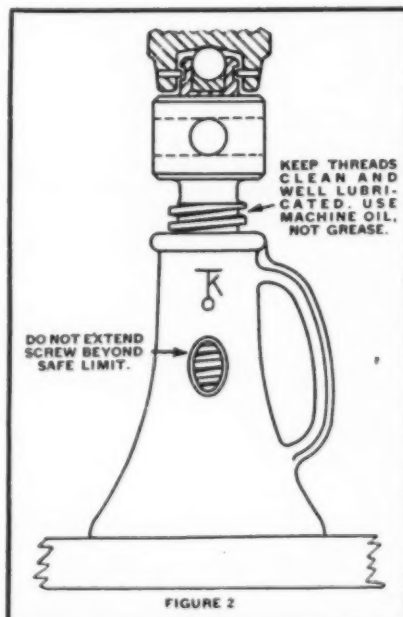


FIGURE 2

load off the pneumatic tires on his portable rock crushing plant, has ingeniously made skirts of washed cement bags, as shown, to keep out dirt. (See Fig. 3.)

With hydraulic jacks, you have the similar problem of keeping the ram clean, as well as the extension screw that telescopes into the ram. (See Fig. 4)

### Center Jack Under Load

A jack's capacity, irrespective of type, is based on the load being placed squarely on the cap. To have the cap or the toe lift barely under the load places undue stress on rack bar, screw or ram, causing premature wear and sometimes damage to the jack. It is,



Figure 3

furthermore, hazardous. Fig. 5 "A" shows wrong loading.

Have good seasoned timber blocking under your jack wherever possible, particularly when working out-of-doors. Blocking increases the area on which the load rests, protecting floors from splintering or cracking and protecting the jack against being pushed into the dirt. It further eliminates the possibility of the load being brought to bear against only part of the base.

Particular attention should be paid to blocking or shimming where the load is not parallel to the floor or ground. Do not have load contacting only part of cap as in Fig. 5 "B"; shim up jack as in Fig. 5 "D", so that cap

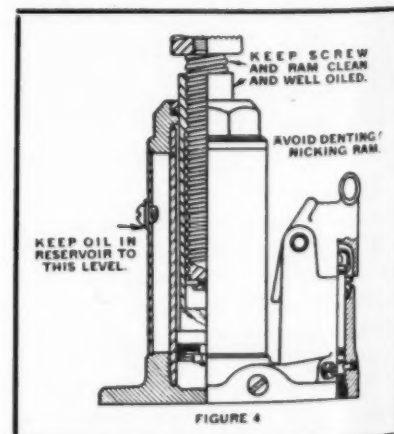


FIGURE 4

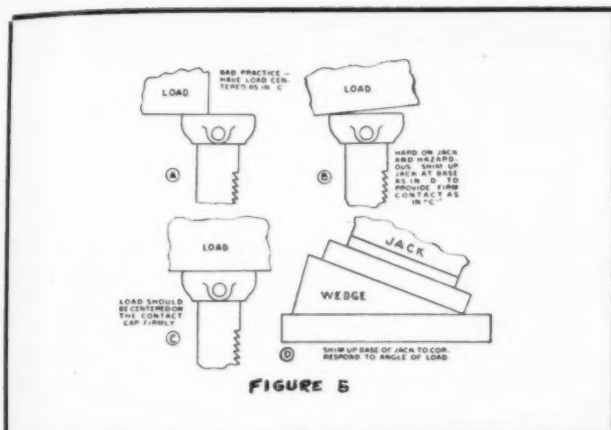


FIGURE 5

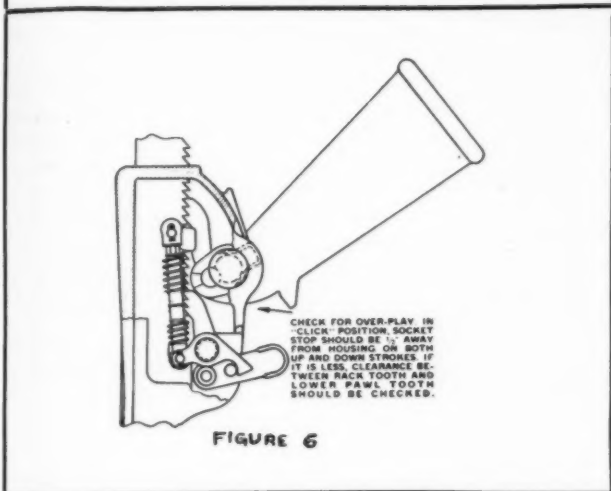


FIGURE 6

and load have firm contact as in Fig. 5 "C."

**Standard Rules for the Care of Jacks**  
To simplify the care and maintenance of common types of jacks, rules to observe governing each type are given, aside from those discussed above.

#### Automatic Lowering Jacks

(1) Check overplay. When the pawl clicks into position, the socket stop should be at least  $\frac{1}{2}$  in. away from the housing on both the up and down strokes. If it has less than this, the clearance should be checked.

(2) Keep spring link clean. Dirt or caked grease interfere with the proper spring tension. Wash it in kerosene occasionally.

(3) Use correct size lever bar or pole. Wrong sizes can damage socket and are dangerous to use. (See Fig. 7)

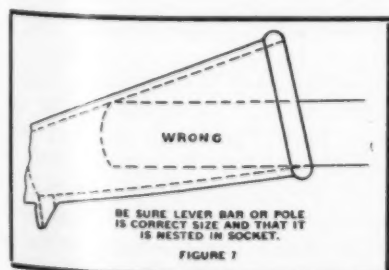


FIGURE 7

(4) Don't mishandle jacks by using them for mawls or by throwing them off trucks or from other heights. Generally malleable, they may not break, but they get out of alignment.

#### Track or Trip Jacks

(1) Check overplay if socket stop is less than  $\frac{1}{2}$  in. from housing. If it has less than this, the clearance should be checked by inserting an 0.083 feeler in the space between rack tooth and pawl tooth with the socket in "click" position. If an 0.083 feeler will not enter, the jack is not safe to use. (See Fig. 8.)

(2) Check spring "click" frequently. It is important because it is a signal

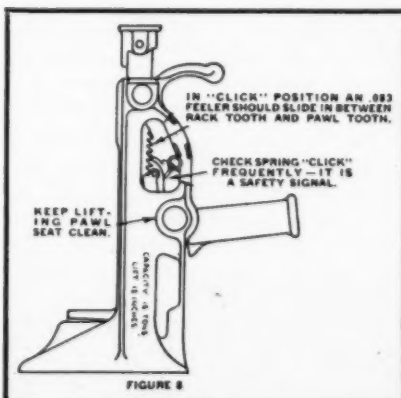


FIGURE 8



## JAEGER PAVING TEAM

—for Faster Airport Paving (Has Laid Over 275 Ft. per Hour of 25 Ft. Width, Over 475 Ft. per Hour of 10 Ft. Width).

—with Greater Density and Uniformity of Slab Due to Spreader Re-Mixing Screw.

—with Precision Smoothness of Riding Surface.

—with Manpower Saved by One-Man Operation and Cutting Final Finishing Time.

Send for Contractors' Reports and Catalog

**THE JAEGER MACHINE CO., 223 Dublin Avenue, Columbus, Ohio**  
Mixers, Pumps, Hoists, Truck Mixers

that the pawl teeth are meshing properly with the rack teeth. (See Fig. 8)

(3) Keep lifting pawl seat clean. Blow out dirt or wash with kerosene occasionally. It helps teeth to mesh properly, providing a maximum bearing area, thereby reducing wear on teeth.

(4) Use proper poles or lever bars. Using the wrong size endangers the operator from slippage and additionally places needless stress on the lever socket. (See Fig. 7)

(5) Do not use jack as a mawl or car stopper. Do not throw it onto ties

**TRANSITS**  
and **LEVELS**

**HEADQUARTERS**  
**FOR REPAIRS—**  
**—any make—**

We will buy or trade in old Transits, Levels, Alidades, etc. Send instruments for valuation.

Write for new Catalogue RS 83 of Engineering Instruments, Engineering Field Equipment and Drafting Room Supplies.

**WARREN-KNIGHT CO.**

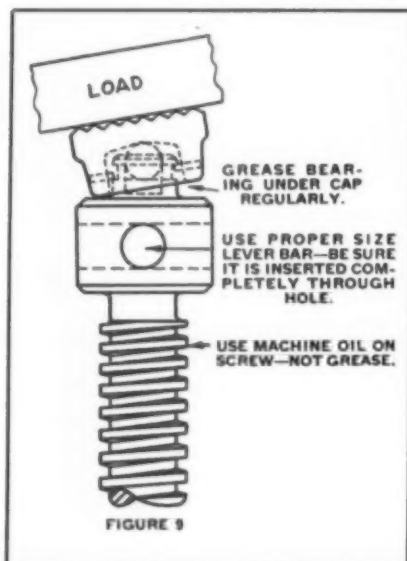
Mfrs. of Sterling Transits & Levels  
136 N. 12th St. • Philadelphia, Pa.

## Equipment Maintenance

or rails. While jacks seldom actually break from rough treatment, they do get out of alignment from abusive handling, endangering operators.

### Screw Jacks

- (1) In lubricating the screw, machine oil is to be used in preference

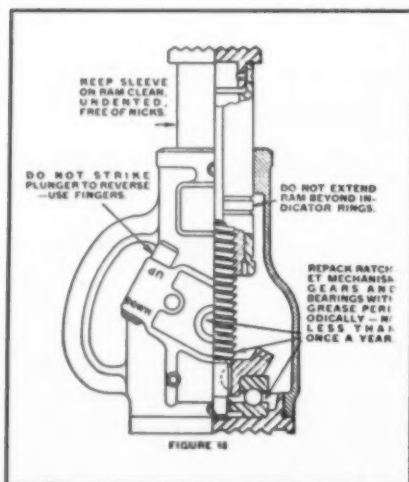


to grease. (See Fig. 2) Be sure bearing under cap is lubricated regularly, using grease. (See Fig. 9)

- (2) Do not extend screw beyond the safe limit. Roughly not more than two-thirds of the screw is to be run out. (See Fig. 2) On Simplex screw jacks, do not extend screw beyond safety peephole in base.

- (3) Use good blocking under base and above cap, if necessary. Having a block under only half of the base can be disastrous.

- (4) Clean screw and housing or base



occasionally to remove grit and then re-lubricate.

### Journal Jacks

- (1) Do not operate or extend ram beyond indicator rings. Generally a safety stop is provided. (See Fig. 10)

- (2) Operate the reversing plunger on the ratchet mechanism with the fingers. Do not strike it with a tool.

- (3) Be sure proper blocking is used, particularly when jacking or pushing at an angle. Improper blocking prevents even distribution of weight, tending to throw internal parts out of line and causing sleeve to bind or scour.

- (4) Keep the sleeve on the ram clean and free from nicks. When jack is used periodically, wash with kerosene once a year, blow out grit and repack ratchet mechanism and gears with grease. (See Fig. 10) Base can be readily removed. When jack is used regularly, do this three times a year.

### Hydraulic Jacks

- (1) Keep oil in reservoirs at correct

level. Refill with proper grade of oil intended for the purpose. (See Fig. 4) Do not expect maximum lift if reservoir lacks oil.

- (2) Keep the ram or sleeve as clean as possible and free of nicks and dents. A clean ram will not carry dirt down into the cylinder.

- (3) Do not use a longer lever bar than the one supplied with the jack. A longer lever makes it possible to lift a heavier load than the jack was intended for, resulting in a damaged jack if not an accident.

- (4) Pay particular attention to the blocking—be sure it extends under the entire base including the "pump" to one side of the housing or cylinder.

- (5) Be sure nuts at top and at base of housing are tight against leakage.

- (6) On those hydraulic jacks where the release valve is not shielded, be sure it is not struck or damaged.

- (7) Do not throw jack down or hammer it under a load. Never allow anything to strike the pump as so doing can damage it beyond repair.

## ODT Establishes Advisory Committees, Maintenance Specialists

IN A MOVE to safeguard the continued operation of existing automotive equipment despite serious shortages of materials and manpower, the Office of Defense Transportation on March 1 announced that it is sponsoring the establishment of maintenance advisory committees throughout the country.

The ODT pointed out that the automotive maintenance problem is twofold:

Present shortages and the possibility of greater future shortages of essential parts, maintenance materials, tools and equipment make preventive maintenance measures a "must" throughout the automotive field.

The need for the development of a comprehensive maintenance program is further emphasized by the growing shortage of mechanics and drivers, and the necessity for training men and women to replace those entering the armed forces and war industries, the ODT pointed out. The shortage of mechanics already has caused the closing of many garages and dealerships.

The original committees are to be appointed on a temporary basis for the purpose of aiding the ODT in organizing permanent maintenance committees, the members of which will represent seven different branches of the automotive industry including private and for-hire carriers, truck factory branches, truck and automobile dealers, garages and parts jobbers.

At the same time, each ODT district office was asked to designate one staff member as "maintenance specialist," whose duties will include the following:

1. To establish and work with the District Maintenance Advisory Committee.

2. To cooperate with WPB's Automotive Branch field force in locating used parts and organizing used parts yards, as well as obtaining essential new parts for trucks that are laid up due to a lack of parts.

3. To cooperate with the Army Motor Transport Division's field force in obtaining parts and service facilities for Army contract trucks and as-



sisting in obtaining Army priorities where necessary.

4. To cooperate with local OPA officials in obtaining tires for trucks, buses and other essential vehicles.

5. To locate garage and maintenance facilities with proper equipment and sufficient manpower to maintain essential transportation equipment.

6. To encourage the rebuilding and reclaiming of essential used parts.

7. To assemble data, with the assistance of the Maintenance Committee, regarding the availability or lack of new and used replacement parts, repair materials, tires, maintenance facilities and mechanics, and to report on the progress of the maintenance program generally.

The basic functions of the District Maintenance Advisory Committees will be:

1. To assist in securing information on local problems relating to maintenance facilities, replacement parts, available maintenance materials, maintenance personnel shortages, and the effect of limitation orders on maintenance.

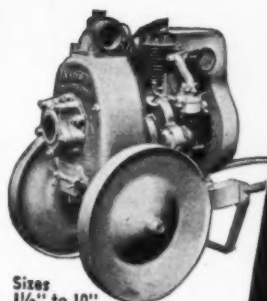
2. To disseminate information to the industry on all regulations which affect vehicle and tire maintenance.

3. To assist automotive, tire, parts and oil companies cooperating in the U. S. Truck Conservation Corps in promoting greater interest in preventive maintenance among vehicle owners, drivers and mechanics.

4. To assist in passing on to maintenance men and establishments the information prepared by the SAE-ODT Maintenance Method Coordinating Committee and its various sub-committees working with the Vehicle Maintenance Section.

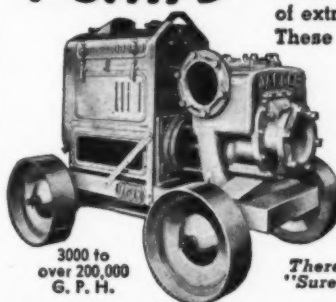
5. To assist and advise dealers, garage owners, jobbers and other maintenance organizations, schools and other interested groups in developing training programs for mechanics and drivers.

6. To assist in gathering information regarding the possibilities of and the procedures to be followed in pooling maintenance facilities, tools and manpower, if and when such action may become necessary or desirable.



Sizes  
1 1/2" to 10"

**Only  
JAEGER  
PUMPS**



3000 to  
over 200,000  
G. P. H.

**THE JAEGER MACHINE COMPANY**

223 Dublin Ave., Columbus, Ohio

CONTRACTORS' PUMPS, MIXERS, HOISTS, PAVING EQUIPMENT

**CERTIFIED HIGH  
PERFORMANCE**

Every Jaeger Pump is  
Individually Tested and  
Guaranteed for Vacuum,  
Capacity and Pressure

**THOUSANDS of EXTRA  
HOURS of SERVICE**  
for Your Future Protection  
as Well as Profit

offer you factory-tested and certified high performance in units of extra heavy duty construction. These pumps are the surest protection your money can buy against pump breakdowns and job delays, the best insurance the contractor can have against the cost and uncertainty of early replacement.

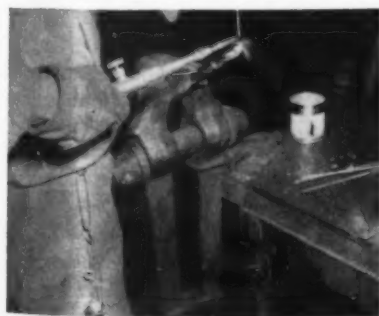
There's a size and type of Jaeger "Sure Prime" Pump to fit any job. Ask for Catalog.

## Brazed Ends Make Wire Rope Safer to Handle

By F. L. SPANGLER, M.E.

Member American Society of Safety Engineers

Where clip fastenings or other means of attachment are used that expose the end of a wire rope, there



Covering the Sharp Wires at the Rope End by Applying Bronze with a Welding Torch

is constant danger that those handling the rope might receive lacerations or puncture wounds from the sharp wires at the rope end. This form of injury is said by some medical au-

thorities to be especially dangerous since it is likely to be deep seated, and the injured man might consider the wound as too superficial to require immediate attention. It is not uncommon for blood poisoning to develop from such wounds where immediate treatment is not given. And now that we need every ounce of production energy—this is no time to have workmen laid up because of injury.

A simple method of eliminating the

hazard of sharp exposed rope ends is to braze the end of the rope with a bronze welding rod, running the bronze back for a distance of an inch or two from the end. When properly done, the bronze covers all the wire ends, and it also has the advantage of holding the rope end intact so that seizings can be removed.

Ends of preformed ropes can be brazed without applying a seizing beforehand, since preforming removes

(Continued on Page 91)

**Don't Scrap it—WELD IT**

**Vitamin—Manganal**

The Steel that gives new life to old parts by welding. Repair your buckets, dipper teeth, frogs, crossings—roll, gyratory crushers, jaw crushers. Better weld now than later.

Repair your broken and worn parts with Manganal—it's the easy, quick and efficient way. Manganal alloy steel welding, wedge bars and shapes give new lives to old parts.

**STULZ-SICKLES CO.**  
NEWARK, N.J.



## With the Manufacturers

### Three Allis-Chalmers Men Move Up

Three important promotions have been announced by W. A. Roberts, manager of the Allis-Chalmers Tractor Division, involving changes in the company's sales and engineering organizations. They are:

(1) A. W. Van Hercke, from sales manager to assistant manager of the Tractor Division. He will coordinate all engineering and development work.

(2) A. F. McGraw, from sales promotion manager to general sales manager, heading up industrial and agricultural sales of the Tractor Division.

(3) R. A. Crosby of the advertising department, temporarily loaned to the Salvage Section of the WPB, will be advertising manager.

As Mr. Roberts' right hand man on development work, Mr. Van Hercke can draw on his experience as implement dealer, agricultural and industrial tractor and equipment salesman and home office sales executive. Originally brought to Milwaukee from the industrial field organization, he at first specialized on sales to counties and other public bodies, later became Pacific Coast divisional sales manager, then implement sales manager responsible for sales of LaCrosse Works products, then sales manager of the Tractor Division.

As salesman and branch executive, A. F. McGraw helped to pioneer power equipment methods in agriculture and road building. He has been

salesman and branch executive in both the industrial and agricultural fields, having been industrial sales manager of the company's Kansas City branch when he was moved to



W. A. Roberts



A. W. Van Hercke



A. F. McGraw



R. A. Crosby

Milwaukee to head the sales promotion department. For the past year he has been chairman of the Advisory Council to the Research Department of the Farm Equipment Institute. He is widely known as a speaker at dealer meetings and conventions.

Mr. Crosby came to Allis-Chalmers with the Rumely Organization. He has been in the advertising department handling agricultural advertising, both space and literature. He

has also been in charge of fairs, exhibits and other advertising functions for the company. His over-all experience suits him ideally for his new position.

### Personnel Changes in White Mfg. Co.

Two changes in its executive personnel have been announced by the White Manufacturing Co. of Elkhart, Ind. W. McKean White, Jr., Vice President, has been given leave of absence and is now 2nd Lieutenant in the U. S. Army Air Corps. At present he is stationed at Wendover Field, Utah, as Assistant Supply and Engineering Officer of the 384th Bombardment Group. Merritt A. King has joined the White Mfg. Co. as Assistant to the President, W. McK. White. Mr. King has had extensive experience in the construction machinery industry. Commencing with the Good Roads Machinery Co., he later was associated with the General Construction Equipment Corp. and with the Hillsman Equipment Co. of Chicago, and with the Godfrey Conveyor Co. of Elkhart, Ind.

### Columbus Plant Gets Army-Navy "E" Award

A streamlined, between-shifts ceremony on Jan. 28 marked the presentation of the Army-Navy "E" award to the Cummins Engine Co., Columbus, Ind., for outstanding production of war materials. In the presence of company employees and executives and guests gathered in one of the plants where Cummins Diesel engines are steadily rolling from the production line to the fighting front, the "E" banner was presented by Rear Admiral W. C. Watts, USN (Ret.). It was accepted on behalf of the company by its president, C. L. Cummins, who pioneered the development of high speed diesel engines. Colonel Walter S. Drysdale, commanding officer of Fort Benjamin Harrison, awarded the "E" lapel insignia—which every Cummins worker will be privileged to wear—to the two employees who have been longest in the company's service, Raymond "Pick" Hammond and Frances Schaefer. Mr. Hammond, a machinist, has been on the Cummins payroll for 25 years and Miss Schaefer, a member of the accounting department, for 17 years. Jeffrey Van Norman, now a worker on the Cummins assembly line but formerly a well known theatre entertainer, presided as master of ceremonies.



Left to right: Adm. Watts, Mr. Cummins, Col. Drysdale



## Cummins Is Appointed Diesel Consultant by WPB

C. L. Cummins, founder-president of the Cummins Engine Co. of Columbus, Ind., manufacturers of Cummins diesel engines, has been appointed Executive Consultant on Diesel Engine Production to the War Production Board, with headquarters in Washington, D. C. The position carries the nominal dollar-a-year salary.



C. L. Cummins

## In the Navy

Maurice V. Cornell, former Sales Representative for The Marion Steam Shovel Co., Marion, O., working out of the home office, has enlisted in the U. S. Navy and has been commissioned a Lieutenant Junior Grade. Ed. T. Bettels, former Sales Representative for The Marion Steam Shovel Company on the Iron Range, has joined the Navy and has been commissioned Lieutenant, U. S. N. R., of the United States Navy.

## Crane Rejoins Templeton, Kenly & Co.

Charles A. Crane has rejoined Templeton, Kenly & Co., manufacturers of lever, screw and hydraulic jacks, as assistant to the president.



C. A. Crane

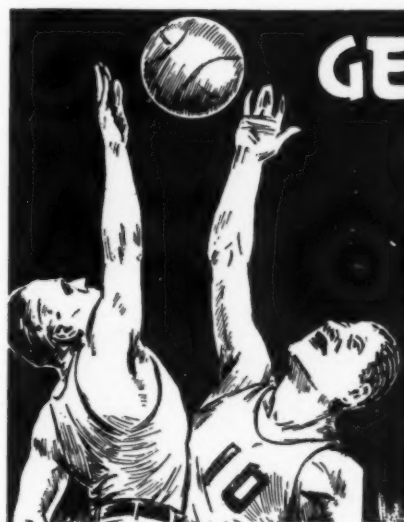
Mr. Crane, an old-timer in the industrial field, graduated from the Chicago Manual Training School in 1898. On his first job, he participated in the building of the first Simplex lever jack way back in 1899, when the company's plant was located in a small shop on East Ontario St. in Chicago.

Many years ago Mr. Crane left Templeton, Kenly & Co., for the construction field, in which work he has gained intimate engineering experience that will be of great value to jack users in all phases of construction work. He is an active member of several leading engineering societies and in his new position will devote part of his time to the development of new types of jacks, as well as the broader application of the company's present line to new industrial applications.

## Caterpillar Tractor Employees Make Safety Records

More than 16,000 employees at Caterpillar Tractor Co. compiled a lost-time accident frequency of 10.3 cases per 1,000,000 man hours of work during 1942 for an all-time plant record, it is announced by H. S. Simpson, Company Safety Engineer. The best record was compiled during the month of November when the frequency rate of accidents dropped to 6.7. In addition, 27 departments completed the entire year without a single lost-time

accident. These records, made during a year of record production and in the face of a general national increase in industrial accidents, emphasize the lack of mental and emotional fatigue, caused by longer work weeks, inexperience, increased production and general war worry, according to Mr. Simpson. Thorough cooperation by employees with the Company's Safety and Sanitation Division, which supervises a never-ending campaign against carelessness, is said to be mainly responsible for the safety record.



## GET THE JUMP ON BUSINESS

Fast efficient operation is the keynote of today's means of doing business. To get the jump and keep the ball rolling requires not only good judgment but the tools to do the job right. And, when you put a SCHRAMM in the game you will get the outstanding performance that is needed to score on every job. Select the model best adapted for your needs... a 20, 60, 85, 105, 210, 315 or 420 cu. ft. capacity.

**LIGHT WEIGHT  
SELF STARTING  
GASOLINE OR DIESEL POWER  
COMPACT DIMENSIONS  
ECONOMICAL ENGINE SPEED  
AUTOMATIC CONTROLS  
LONG LIFE  
FORCE FEED LUBRICATION  
COMPRESSOR EFFICIENCY**



**SCHRAMM INC., THE COMPRESSOR PEOPLE**  
WEST CHESTER, PA.



## Caterpillar Tractor Co. Gets Army-Navy "E"

Caterpillar Tractor Co., Peoria, Ill., has been awarded the Army-Navy "E" symbol for outstanding achievement in the production of war material.

Presentation of the "E" flag will be made at appropriate ceremonies within the plant Friday, March 12. Brigadier General D. McCoach, Jr., Assistant Chief of Engineers, and Captain E. A. Lofquist, Chief of Staff, Ninth Naval District, will make the award. In addition to presenta-

tion of the "E" flag to be flown at the "Caterpillar" plant, an individual "E" pin will be given each employee, signifying his outstanding contribution to the war effort.

## Davies Mine Director of Physical Research for Goodrich

John M. Davies, in the research division of The B. F. Goodrich Co. since 1926, has been named director of physical research. A resident of Summit County, Ohio, all his life, Davies is a graduate of Central high school and the University of Akron

where he received his science degrees. He also did graduate work at the University of Chicago. He was an instructor in physics at University of Akron before joining B. F. Goodrich as a physicist becoming a group head in the physical research department in 1939.

## R. B. Thomas Elected Secretary American Institute of Steel Construction

Roberts B. Thomas has been elected Secretary of the American Institute of Steel Construction, 101 Park Ave., New York, to succeed V. G. Iden, who has joined the staff of the Bureau of National Affairs of Washington, D. C. Mr. Thomas will continue as General Counsel of the Institute, the duties of the two offices having been combined for the duration in the interest of conservation of manpower. Mr. Thomas has been engaged in the practice of law in New York City since 1917, except for two years during the First World War in which he served as a first lieutenant in the 309th Machine Gun Battalion, 78th Division. He is a member of the Association of the Bar of the City of New York the New York State Bar Association and the American Bar Association. In addition to being General Counsel of the American Institute of Steel Construction, Mr. Thomas serves in like capacity the Iron League of New York, Inc., and the National Mineral Wool Association.

## Headden Appointed Supervisor

William P. Headden has been named supervisor of the fuels and lubricants section of the Engineering Division of Esso Marketers.

Mr. Headden has been active in the Engineering Division of the company for 14 years. A graduate of Rensselaer Polytechnic Institute in 1920, he was employed at the Bayway (N. J.) refinery as a student engineer. He was later assigned to research, primarily in the automotive field, as well as to editorial work on technical publications. In 1934 he moved to 26 Broadway, New York City, with the Engineering Division, and in 1937 he was promoted to assistant supervisor of the fuels and lubricants section. Charles W. Bobmer, Jr., who has just been appointed assistant supervisor of the fuels and lubricants section, is a graduate of the University of Pennsylvania. He worked as a chemical engineer at the Standard Oil Development Company and was transferred to the Field Service Division in 1933. When this

# STAMP OUT DECAY!

## APPLY OSMOPLASTIC to these Danger Spots

**1** Where piling touches cap and sway-bracing.

**2** Between and atop planking joists. Also where laminated deck seats contact cap (when treated planking not available).

**3** At the ground line or waterline of piling.

**4** Where rail posts touch handrails, hub guards, deck and cap.

Highway engineers who "know their stuff" know that decay of bridge timbers means heavy repair costs... plus valuable man-hours lost! And with treated timber mighty scarce today, effective "spot" treatment is the only way to prevent rot.

Apply OSMOPLASTIC to the vulnerable sections where decay usually starts. Wherever timber touches timber... or humid earth... or stands in water... OSMOPLASTIC adds extra years of service.

The cost of applying this superior wood-preservative with ordinary labor is amazingly low. OSMOPLASTIC protects all your timber installations, whether bridges... culverts... highway guard-rails... guide or fence-posts.

Save your timbers today from decay tomorrow... with OSMOPLASTIC!

(P. S.: Osmoplastic has a surface coverage of approximately 75 sq. ft. per gallon!)

Osmose Wood Preserving Company of America, Inc. Dept. R  
1437 Bailey Avenue, Buffalo, N. Y.

Please send me full information on Osmoplastic applications.

Name \_\_\_\_\_

Address \_\_\_\_\_

City and State \_\_\_\_\_

# OSMOSE

## WOOD PRESERVING COMPANY OF AMERICA, Inc.

BUFFALO, N. Y.

DENVER CHICAGO NEW YORK  
KNOXVA, W. VA. BIRMINGHAM  
SEATTLE SAN FRANCISCO

division was transferred to the Standard Oil Company of New Jersey, he came with it as a lubrication engineer.

### Name A. N. Morton Mack Production Chief

Appointment of A. N. Morton as production manager of the Mack company's three huge plants has been announced by Charles T. Ruhf, president of Mack Manufacturing Corp. and executive vice president of the parent company, Mack Trucks, Inc. Mr. Morton, formerly factory manager of the Plainfield, N. J., plant, in his capacity of production manager will extend his duties to the New Brunswick, N. J., and Allentown, Pa., plants as well. In taking over his new position, Mr. Morton follows Mr. Ruhf, who had been operating vice president in charge of the factories before assuming the presidency. The three plants he will manage have all received the coveted Army-Navy "E" for excellence in war production. As production manager he becomes boss of a total of more than 2,500,000 sq. ft. of floor space on which Mack produces in peace-time one of the most complete lines of trucks in the world. These range from light delivery vehicles to mammoth six-wheelers which can handle loads up to 50 tons.

### A Manual on the Conservation of Construction Equipment

An 80-page book, *Conservation of Construction Equipment and Facilities*, has been published by the Associated General Contractors of America as an aid in the war effort, through conservation of critical materials and maintenance of equipment, now impossible to replace, in usable condition for any performance that may be demanded from it.

Of convenient pocket size, the book is designed for use by key men directly responsible for the operation and maintenance of equipment and critical materials.

Opening chapter of the book is entitled *Plant Layout* and presents suggestions for laying out a construction project so as to conserve manpower and economize in the use of critical materials. *Construction Equipment* is the title of the second section which presents basic principles governing use, care and repair of equipment.

Separate chapters are devoted to internal combustion engines, electric equipment, automobiles and trucks, small tools, rubber, wire rope and manila and hemp rope, tarpaulins and canvas, scaffolding and steel piling and forms.

Forty-three various items of construction equipment are listed briefly in a "Glossary of Maintenance Hints," which give specific points that require special attention and suggested methods of preventing and curing trouble.

Fire prevention and fire fighting are covered by a chapter of the manual, and another chapter covers accident prevention. Sabotage precautions are outlined in one section.

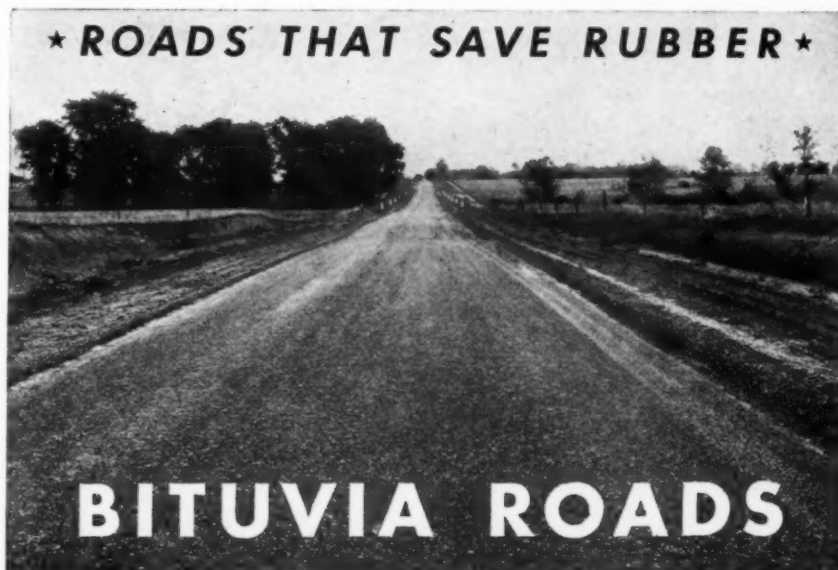
Final chapter of the book is devoted to salvage and reclamation,

which, the manual points out, should be a continuous activity to be vigorously pursued.

A reference list is included, giving the names of manufacturers of various kinds of equipment, from whom further literature and suggestions may be secured in connection with maintenance of their equipment.

Copies may be secured from the Construction Foundation, Munsey Building, Washington, D. C., at 50 cents each, \$5.00 per dozen and \$25.00 per hundred.

## ★ ROADS THAT SAVE RUBBER ★



## BITUVIA ROADS

## are Easy on Tires . . .

► The highly resilient, skid-resistant surface of BITUVIA roads is easy on tires—helps save vital rubber. BITUVIA's deep penetration and firm binding properties make for construction and maintenance economies, and the speed with which it can be applied makes BITUVIA the logical material for emergency road construction and repair jobs where time is a vital consideration. Standard grades to meet any Federal, State, County or Municipal specifications.

REILLY PLASTUVIA is a plasticised coal tar filler which binds firmly to concrete, brick or stone surfaces, effectually filling and sealing cracks and openings between surfaces to prevent water damage. PLASTUVIA will not flow or "pull" in summer nor chip in winter.

**Complete information on these products will be sent on request.**



## REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

SEVENTEEN • PLANTS • TO • SERVE • YOU

ROADS AND STREETS, March, 1943

## New Equipment and Materials

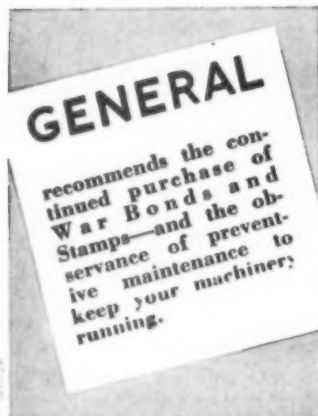
### Tournaweld RW (Roller-Weld) Is Newest Electrode

Tournaweld RW (Roller-Weld), specially developed for use in building up track rollers, rails and other similar parts of machines subjected to a combination of impacts and heavy bearing wear, is being introduced by

R. G. LeTourneau, Inc., Peoria, Ill. This new electrode is stated to be characterized by rapid burn-off, smooth operation and uniform deposit of highly alloyed, tough, hard surfacing metal which is sufficiently soft in the as-deposited condition to be ground according to the best practice employed in rebuilding track rollers.



## GENERAL SUPERCRAANE!



Why Super? Because it is better! — Because it requires but one operator, and has but one engine—yet is mounted on rubber tires, steers hydraulically, moves without tracks or overhead connections—goes most anywhere. The SUPERCRAANE will handle more material faster, easier, and for less cost. Available as Crane, Clamshell, Dragline and Pile Driver.

**The OSGOOD COMPANY**  
SIZES: 1/2 to 2 1/2 Cu. Yd.  
Diesel Or Gas Electric  
Associated with  
The GENERAL EXCAVATOR CO.

**The HERCULES COMPANY**  
HERCULES  
"IRONROLLERS"  
6 to 12 Tons  
Diesel or Gasoline  
Associated with  
The GENERAL EXCAVATOR CO.

**GENERAL**  
SIZES:  
3/8 - 1/2 - 3/4 - 1 Cu. Yd.  
Diesel—Gas—Electric  
SHOVELS  
DRAGLINES - CRANES  
Crawler & Wheel Mounted  
THE GENERAL EXCAVATOR COMPANY, Marion, Ohio

Tournaweld RW (Roller-Weld) operates with greatest efficiency on reverse polarity with a DC welding machine. The rod is black in color and comes 14 in. long, in diameters of 5/32 in., 3/16 in. and 1/4 in. It has been thoroughly field tested.

### Tractor & Equipment Co. Buys Equipment of Ed Gantt & Co.

Tractor & Equipment Co. has purchased the parts stock and equipment of the Ed Gantt Machinery Co. Sales and service of the following lines of equipment will be continued at the same location, 4401 First Avenue, North Birmingham, Alabama, with the same personnel:

International Harvester Co., J. A. Adams Company, Bucyrus-Erie Tractor Division, Northwest Engineering Co., Worthington Compressors, Jaeger Machine Co., Euclid Road Machinery Co.

### New Aircraft Starter Unit

A new, portable aircraft starter unit, known as the Nite-Hawk "Aero-Start", has been announced by Lister-Blackstone, Inc., Milwaukee, Wis., manufacturers of Nite-Hawk floodlight and searchlight units. It provides power for starting all electrically started aircraft engines by simply



Nite-Hawk Aero Start

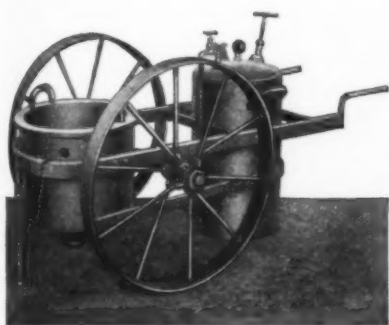
plugging in to the control panel. The outfit, according to the manufacturer, possesses the distinct advantage of delivering constant voltage during the starting cycle, which means quicker take-offs. A balky aircraft engine can be "rolled" continuously. The same holds true for engines in the maintenance shop. A pair of 24-volt floodlights, mounted on telescopic adjustable supports, on the front of the "Aero-Start", supply light for night operations. The outfit consists of a steel-housed, spring-mounted trailer unit as illustrated, in which is housed



a direct current electric generator that delivers up to 500 amperes at both 12 and 24 volts. Power is supplied by a 19 horsepower, 4-cylinder, air-cooled gasoline engine, complete with electric starter. Large tool boxes on each side of the assembly provide space for storage of cables, tools and accessories. National distribution is handled by the Graybar Electric Co. with branches located in 86 principal cities throughout the United States.

### New Lead Melter

For melting of lead, babbitt and other soft metals a new Model D-2 lead melter is being produced by the White Manufacturing Company of Elkhart, Ind. This melter is furnished with removable cast iron pot



New White Lead Melter

having capacity of 430 lb. It is equipped with oil burner, for kerosene or distillate, and has 15-gal. capacity fuel tank. The tank is provided with hand air pump, pressure gauge, safety filler and oil strainer valve. The unit is mounted on 30-in. diameter steel wheels. It can thus be moved readily over rough terrain as well as being convenient for use in industrial plants or on hard surfaces. It has a folding leg to prevent tipping over. Its shipping weight, uncrated, is 425 lb.

### New Bulletin on Soils

The Engineering Experiment Station of Purdue University, Lafayette, Ind., will soon release Highway Research Bulletin No. 89 entitled, "The Formation, Distribution, and Engineering Characteristics of Soils." In this bulletin detailed discussions of the principles of soil formation, the use of aerial photographs in soil mapping, some foreign soil conditions, highway and airport soil problems, and engineering classification of soils are combined with a variety of illustrations to establish a clear correlation between geology, pedology, and

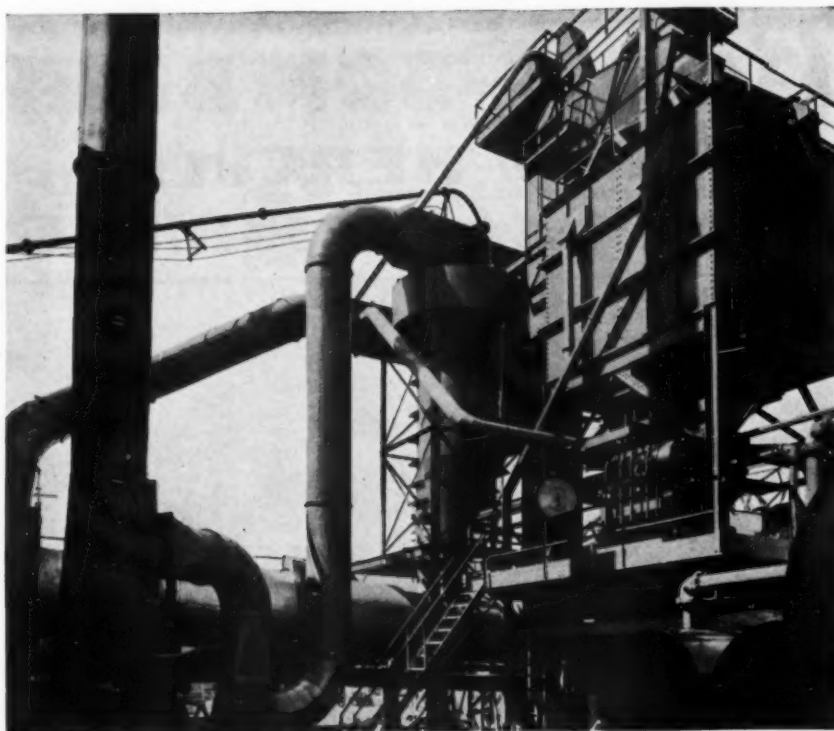
the engineering properties of soils. In addition, profiles with detailed descriptions of 146 soils occurring in Indiana and many other states are presented on an engineering test basis.

### Contract Let for Raising Two 1700 Ft. Bridges

The Rust Engineering Co., Birmingham, Ala., has been awarded the contract at less than \$1,000,000 for raising two bridges spanning the Ten-

nessee River. The work is necessitated by the construction of the Gilbertsville, Ky., dam by the T. V. A. One bridge will be raised 25 ft., the other 14 ft. Each bridge is about one-third mile long.

In the work the contractor will use a bridge-raising gantry crane of 200 ton capacity, jacks with capacities up to 300 tons, and precast concrete cribbing, previously adapted for this type of engineering by the contractor. An innovation will be the employment of patented steel forms.



## Newest Developments

### in Stationary and Portable Asphalt Plant Design...



THE  
"Brass Brain"  
(FLUIDOMETER)

This automatic metering system saves time, materials—insures uniformity. For all types of plants.

● Nearly 50 years ago Hetherington & Berner built the first asphalt mixing plant to be constructed in America. From that day to this we have specialized in the design and production of asphalt plants—continually working to improve their efficiency. H & B asphalt plants of today—both stationary and portable—incorporate the latest developments in design which have been proved in performance. Specifications conform to the most rigid state and city requirements, both as to engineering design and safety regulations. Write for Bulletin RS-260.

HETHERINGTON & BERNER Inc.  
INDIANAPOLIS • INDIANA

*Hetherington & Berner*



### Highway Traffic Decreases

Traffic on rural roads was off 48 per cent in the newly-rationed area and 49 per cent in the eastern rationed area in December compared with the same month a year ago, according to counts of more than 500 "electric eye" recorders, according to the Public Roads Administration of Federal Works Agency announced on Feb. 7. The counts were reported by 43 State highway departments.

Traffic on 58 toll facilities in the newly-rationed area decreased 35 per cent in December and 9 per cent in November, compared with the corre-

sponding months a year earlier, Public Roads Administration added. The December decrease on 22 toll facilities from Maine to Florida was 19 per cent. The decrease in passenger cars in December on the Pennsylvania Turnpike and on Fleetwood Viaduct, Westchester County, New York, was more than 70 per cent. Truck and bus traffic on the Turnpike decreased only 9 per cent.

The 49 per cent decline in traffic on rural roads in the East in December compares with declines of about 42 per cent the previous two months, and is accounted for in part by the elimi-

nation of Christmas pleasure driving, the reduced value of gas coupons, and the week-end gasoline "freeze" order late in the month, Public Roads Administration stated.

The 48 per cent decline in the newly-rationed area compares with decreases of about 23 per cent in previous months, and is also explained in part by the elimination of Christmas pleasure driving.

Twenty-eight traffic-recorder stations in Texas, for example, showed average weekly traffic of about 83,000 vehicles just before the 1941 Christmas week, compared with about 115,000 during Christmas week that year. In 1942, however, pre-Christmas travel averaged about 51,000 vehicles a week, while Christmas-week travel totaled about 55,000 vehicles.

The 48 per cent decline in the newly-rationed area may also have been due in part to a psychological reaction on the part of motorists subjected for the first time to rationing, Public Roads Administration said. This same excessive reaction to the first few weeks of rationing seems to have occurred in the East. During the last two weeks of May when rationing first began, the decline was 45 per cent. In June, however, motorists apparently had accustomed themselves to their allotment of gasoline and the decline was only 38 per cent.

### 1942 Traffic Toll Down 30%

One result of thinning traffic under gas rationing is a sharp reduction in traffic accidents, according to W. G. Johnson, National Safety Council Chief Statistician, writing in *Public Safety*. Motor vehicle deaths in 1942 totaled 27,800, as against 40,000, the all-time-high figure of 1941.

But the picture is "good" only relatively. Two-thirds of these deaths, or 18,500, as well as two-thirds of the million non-fatal injuries, were to workers vitally needed in the war. The 1942 rate represents a 17 per cent drop in the conventional mileage death rate. However, based on the demonstrated tendency for collisions to vary as the square of the vehicle mileage, the drop should theoretically have been 21 per cent.

As might be expected, relatively fewer of the 1942 accidents occurred on rural highways where traffic was most restricted both in speed and volume. The percentage of urban accidents to all accidents rose from 48 per cent in 1941 to 54 per cent in 1942. A 38 per cent drop in fatal collisions between motor vehicles was the outstanding decrease, the 36 per cent reduction in non-collision (ran off the road) accidents being of similar significance.

## Bases for BOMBERS

★ Made by **HERCULES**  
★ Delivered by **HERCULES**



Besides HERCULES Speedraulic Hoists and Dump Bodies for civilian use and the huge Cargo Bodies produced for the U. S. Army, thousands of Airplane Landing Mats for emergency "Bomber Bases" have been turned out by the big Hercules plant the past year. HERCULES Dump Cargo Bodies, like the one shown above, mounted on a Chevrolet chassis, are used

for transporting such materials on many fronts.

Heavy production for war will continue in all lines until victory is won, but if your need is essential, your Hercules distributor can take care of you.

#### REMEMBER THESE "HERCULES" FEATURES!

- Exclusive Center-Lift Hoist Action
- Double Bridge-type Lift Arms
- Balanced Piston Valve, with finger-tip control
- 6", 7", 8" and 10" Hoists

**HERCULES STEEL PRODUCTS CO.**

**GALION, OHIO**

ROADS AND STREETS, March, 1943



# CORONACH

*"Of those immortal dead who live again  
In minds made better by their presence."*

C. E. MYERS, Colonel, Corps of Engineers, and well known in the highway and municipal fields, was killed in action recently. Mr. Myers was engaged in consulting practice in Philadelphia at the time of the outbreak of the war, and had recently served as a Director of the American Society of Civil Engineers and was a former president of the Philadelphia Section.

Mr. Myers taught at Pennsylvania Military College from 1909 to 1911, and from 1911 to 1921 served the Pennsylvania State Highway Department except for a year in which he served as a Captain and a Major in the U. S. Corps of Engineers in the first World War. From 1921 to 1932 he was with the City of Philadelphia, successively engineer of construction, deputy chief of Bureau of Highways, and director of the Department of City Transit.

PATRICK T. COX, president of the P. T. Cox Construction Company, Inc., 270 Broadway, Manhattan, died here yesterday of pneumonia in his home, 8 Grosvenor Street, after a week's illness, at the age of 75.

The Cox firm, which recently received the Navy E Production Pennant for excellence in its work at the Naval Torpedo Station, Newport, R. I., was one of the contractors for the West Side Highway, East River Drive, and the Triboro Bridge.

CHESTER H. STEVENS, 62, city engineer at Mason City, Ia., for nearly 20 years, died recently as a result of a heart attack. He moved to Mason City in 1907 and engaged in private engineering practice until April, 1923, when he was appointed city engineer. He planned and carried through the construction of much of Mason City's pavement, sewers, storm sewers, sidewalks and bridges.

JOSEPH P. MCGOVERN, 53, president of John P. Condon Corporation of Watertown, Mass., died recently. Mr. McGovern was well-known throughout the highway construction industry in New England, and had engaged in the construction of roads of all types. He was efficient in his work and his passing is a loss to the industry. He became president of the John P. Condon Corporation about 12 years ago. Lately, he had been engaged in airport construction at Windsor Locks, Conn.

PATRICK J. HOLLAND, of Lawrence, Mass., died in February. He was an active road building contractor during the period from 1925 to 1932, and built many important sections of highways in the states of New Hampshire, Vermont and Massachusetts. In recent years he operated Canobie Lake Park, in Salem, N. H., of which he was the owner. He was a veteran of World War I and was prominent in the Ancient Order of Hibernians.



The Universal Unit Power Shovel Corporation was the first Wisconsin manufacturer to receive the much coveted U. S. Army-Navy "E" Award . . . for excellence in the production of war equipment.

**T**ODAY is not too early to begin planning and preparing for that tomorrow when warring nations shall have laid down their arms and declared a permanent armistice against destruction. And that day will herald the world's greatest era of new construction.

New equipment will be needed. Faster equipment. Rugged, dependable earth-moving machinery. You will need Power Shovels that move fast, and bite hard and deep. Shovels, cranes and draglines that are quick on the swing, steady and positive on the "crowd", easy to handle, and versatile in their operations. You can expect this, and much more, from UNIT equipment.

UNIT Power Shovels will be ready for tomorrow's operations. Greatly expanded production facilities (now devoted exclusively to war work), plus long-range planning and broad engineering experience in the construction field, are basic factors that will contribute to the quick availability of UNIT Equipment . . .  $\frac{3}{8}$ -,  $\frac{1}{2}$ -, and  $\frac{3}{4}$ -yd. sizes.



BUY BONDS FOR  
VICTORY



**UNIVERSAL UNIT  
POWER SHOVEL CORP.  
MILWAUKEE, WIS., U. S. A.**



**SIMPLE** to Maintain  
**HANDY** to Adjust  
**EASY** to keep Ship-Shape

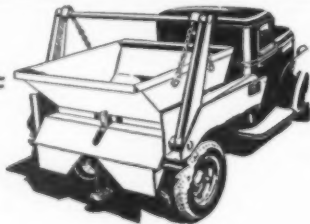


For complete specifications and delivery of any of Byers  $\frac{3}{4}$ - $\frac{1}{2}$ - $\frac{3}{4}$ -yd. gas or diesel power shovels, cranes, draglines or back hoes on crawler or truck mountings, see the nearest Byers sales and service headquarters, or wire factory.

DISTRIBUTORS THROUGHOUT THE WORLD

*Specify*  
**BYERS**  
CRANES and SHOVELS  
RAVENNA, OHIO  
DISTRIBUTORS THROUGHOUT THE WORLD

Only 15  
seconds for  
loading or  
dumping



Fits on any  
standard  
truck chassis

## Brooks **LOAD LUGGER**

saves time, tires, and trucks

You can handle more payloads per day by mounting a **LOAD LUGGER** on the truck chassis, because the Brooks system makes possible *continuous* hauling and dumping without wasting time waiting for the men to load the truck at each trip. By using more buckets, you can get along with fewer trucks, saving upkeep on your equipment. In addition to the Tilt-type and the Skip-type Bucket, there is now available the new Brooks Refuse Container . . . for handling garbage and waste. Be sure to ask for details of this unit.



Use 5 to  
10 dump  
buckets  
with each  
Load  
Lugger for  
maximum  
economy

Write for Catalog No. 44.

Distributors in all Principal Cities.  
503 Davenport Road

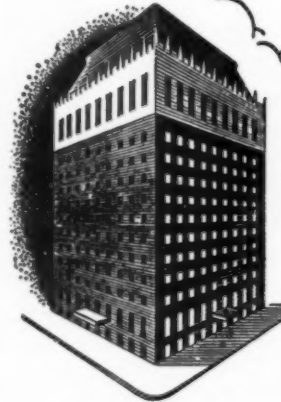
**Brooks** EQUIPMENT & MFG. CO  
KNOXVILLE TENNESSEE

ROADS AND STREETS, March, 1943

## Omaha is Proud...



of this outstanding hotel, noted as the civic, social and travel center of the city. There's far more to enjoy but it is far from being expensive.



## HOTEL FONTENELLE

Official A.A.A. hotel. Home of the National Aeronautic Assn. Headquarters of civic clubs including: Rotary, Kiwanis, Blue Goose, Lions, Optimists, Ad-Sell, Omaha Executives.



## CAN'T GET 'EM UP in the morning!

It's those luxuriously comfortable  
beds at all  
**DeWITT OPERATED HOTELS**

In Cleveland  
**HOTEL HOLLENDEN**

In Columbus  
**NEIL HOUSE**

In Lancaster, O.  
**THE LANCASTER**

In Corning, N.Y.  
**THE BARON STEUBEN**

Check IN

THED. DeWITT

PRESIDENT



## Personal Items about Engineers

### Appoints New Minnesota Chief Engineer

M. J. Hoffmann, Minnesota Commissioner of Highways, recently an-



Orin L. Kipp



G. G. Gladman

nounced the appointment of Orin L. Kipp as Assistant Commissioner of Highways and Chief Engineer of the State Highway Department, to succeed the late J. T. Ellison, and Gordon G. Gladman as Engineer of Plans and Surveys.

Mr. Kipp has been connected with

the Minnesota Highway Department since 1914, being appointed first as engineer for the State in Redwood County, Minn., and in the fall of 1916 being transferred to the Central Office and placed in charge of federal aid construction which was initiated at that time under the Federal Aid Highway Act. When the trunk highway system was established in 1921, Mr. Kipp was appointed as Construction Engineer, having charge of surveys, plans and construction and, early in 1939, he was appointed Acting Chief Engineer of the Department for five months while Mr. Ellison was on leave of absence. On July 1, 1939, he was appointed Assistant Chief Engineer and Planning Engineer. He has served since 1928 as Chairman of the Committee on Road Design of the American Association of State Highway Officials, and was selected as a member of the Special Committee on Administrative Design Policies of that Association. He has also been

active in the work of the Highway Research Board.

Gordon G. Gladman entered the employ of the Highway Department in 1921 as Engineer of Surveys after serving two years on the Itasca County Minnesota Engineers' staff. In 1925 he was appointed as Division Engineer, and in 1929 became Engineer of Surveys and Design which position he has held until the present promotion.

### Brazed Ends Make Wire Rope Safer to Handle

(Continued from Page 81)

all unbalanced stresses in the rope wires and strands so all wires hold their position in the rope without the need for using seizings. Even so, a single seizing will insure that the rope construction will not be flattened during the cutting operation. If the rope is not preformed, it is recommended that two or three seizings be applied—one close to the end of the rope and the others a short distance (4 to 6 in.) apart.

Where end brazing is done, either the same torch or a cutting torch may be used to sever the rope before bronze is applied to the end.

# WILLIAMS *Buckets*

## WELDED ROLLED STEEL CONSTRUCTION for LONGER LIFE

MULTIPLE ROPE & POWER ARM TYPES  
DRAGLINE • POWER WHEEL • DREDGING  
STEEL MILL BUCKETS  
¾ yd. to 16½ yd. capacity

Send for free bulletin covering types of buckets for your particular requirement. It shows details of design and many exclusive features that clearly prove why your next bucket should be a Williams.

**THE WELLMAN ENGINEERING CO.**  
7003 Central Avenue • Cleveland, Ohio

## BUILT BY WELLMAN






**One  
Man  
SPREADER**



## **Flink-Faster-Lower Cost Ice Control & Seal-Coating**

### **SAVED \$7,000**

A northern city writes:  
"We saved about \$7,000 spreading sand alone our first season. Paid for the cost of Flink spreaders nearly 6 times over."

Another city writes,  
"Ice is no longer a problem. Now we get our intersections covered fast."

Let us show you these and other letters.

The truck driver operates the Flink one man spreader. For this reason, and because it spreads faster, one truck with a Flink spreader does as much as 3 trucks with hand shovels . . . an answer to the manpower shortage. The Flink spreader fits all standard dump bodies—does not limit use of truck. Spreads all granular materials up to 1" wet or dry, forward or backward, full width or half width of street. A Flink spreader will pay for itself in 60 days in labor saved—in extra spreading. Write for literature.

#### **THE FLINK CO.**

Streator, Illinois

For particulars write our nearest representative:

#### **WICO SALES**

5134 W. Cullum, Chicago  
GEO. M. CRAWFORD  
Empire Bldg., Pittsburgh  
O. W. CLEMENTS  
421 Townsend Ave., Columbus

## **GRUENDLER CRAFTSMANSHIP**

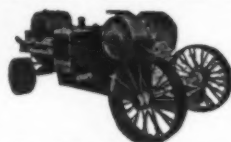
**Employed by U.S.A. in the WAR EFFORT**

**For Access Road and Air Base Construction**

## **PORTABLE CRUSHERS**

**Proper Size Aggregates—on the Job**

Balanced, Non-Tipping. Expertly designed to meet your exact requirements in proper size aggregates—larger capacity and quick mobility to and from job.



Four Wheel Maintenance  
JAW CRUSHER with  
Power Unit

#### **GRUENDLER ENGINEERS**

On the job to help you in any way, NOW and for your Post War Plans. Blue Prints or Practical Suggestions sent—No obligation.



Write for . . .  
Bulletins and  
Illustrated  
Catalog No. 601

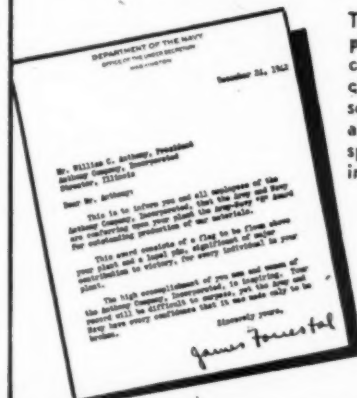
**GRUENDLER CRUSHER & PULVERIZER CO.**  
PLANT and MAIN OFFICE - 2915-17 N. MARKET - ST. LOUIS, MO.

ROADS AND STREETS, March, 1943

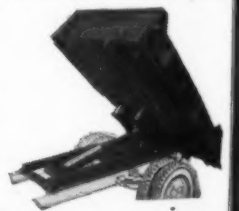


**'ANTHONY'**  
HYDRAULIC  
HOISTS AND BODIES

## **★ ★ Award "FOR OUTSTANDING PRODUCTION OF WAR MATERIALS"**



The Anthony Co. and its Employees are proud of this accomplishment . . . It is a fitting climax to our 25 years of conscientious service to the Hoist and Body industry. It is an inspiration to better our record in 1943 and for years to come.



**NOW IN OUR 25th ANNIVERSARY YEAR**

**ANTHONY COMPANY, INC.**  
STREATOR \* \* \* ILLINOIS

## **DIRT MOVING EQUIPMENT**

Highway construction involves more dirt moving than any other branch of engineering construction. **ROADS AND STREETS**, the only national engineering construction magazine devoted exclusively to, and covering all sections of, the highway field is the most effective and economical medium through which to sell dirt excavating, grading and hauling equipment.



## Iowa State Students Again Win Bridge Design Contest

For the second consecutive year students of Iowa State College won the first, second and third prizes in the annual student bridge designs competition of the American Institute of Steel Construction. The awards were as follows:

First prize, \$200—George W. Russell, Iowa State College.

Second prize, \$100—N. Clifford Prall, Iowa State College.

Third prize, \$50—Curtis D. Hicks, Iowa State College.

The subject of the design for this year's competition was a steel grade separation bridge carrying a highway over a four-track railroad, a navigable canal, and a dual four-lane highway to which there are connections with the overhead crossing.

Certificates of honorable mention were awarded to John R. Leary, Pennsylvania State College; and Charles R. Vosburg, W. David Frevert, Robert Lueder and Clarence F. Rost, all of Iowa State College.

These awards were made by a jury of nationally-known architects and engineers consisting of Mr. Hugh Ferriss, architect; Mr. Arthur C. Holden of Holden, McLaughlin & Associates, Architects; Mr. F. A. Burdett, Consulting Engineer; Mr. Howard Myers, Editor of The Architectural Forum, all of New York City; and Mr. Morris Goodkind, Bridge Engineer, State Highway Department of New Jersey, Trenton, New Jersey.

Sixty-two students from six colleges participated in the competition, as follows:

Iowa State College, Pennsylvania State College, University of Oklahoma, University of Michigan, Columbia University, New York University.

## Roster of Nation's Scientists Prepared

Detailed information concerning the qualifications of more than 500,000 of the nation's scientists and professional men and women has now been catalogued by the National Roster of Scientific and Specialized Personnel and over 140,000 names have been certified to agencies engaged in the war effort.

Through the Roster various war agencies have not only received the names of thousands of individuals for full time positions but they have also obtained the services of many scientific leaders to serve as consultants for short periods of time.

In co-operation with the Selective Service System, the Roster is continuing the task of completing the registration of all men from 18 to 65 years of age who have scientific or professional training or experience.

Many of the most eminent scientists of America have collaborated in devising classification methods which can produce from a central register any desired combination of scientific skills within a few hours' time.

The central organization of the Roster was established jointly by the United States Civil Service Commission and the National Resources Planning Board in June, 1940, as a precise index of the country's scientists and other specially qualified citizens. The job of developing and administering the Roster was placed in the hands of Dr. Leonard Carmichael, president of Tufts College and internationally known psychologist, who was named director; and of James C. O'Brien, experienced Civil Service Commission executive, who was appointed executive officer. The Roster now functions under the Manpower Commission and is associated with its Bureau of Placement.

## SILVER KING HIGHWAY MOWER



● Watch out for those minor damages that might put your highway mower out of action for the duration. A little extra care prevents extra wear and repair!

If you own a Silver King, you'll see, more than ever, what it means to have a mowing unit ENGINEERED for the job. If you want replacement parts now to insure tip-top "good-as-new" performance tomorrow, write. We will be glad to serve you.

MANUFACTURED BY  
**THE FATE-ROOT-HEATH CO.**  
PLYMOUTH, OHIO

## PIONEER CONVEYORS

Sectionalized Steel Frames  
Save Time—Money and  
Material.

★ ★ ★ ★ ★  
Specify Pioneer on  
your next job.

**PIONEER ENGINEERING WORKS**  
1515 CENTRAL AVE. MINNEAPOLIS, MINNESOTA  
Manufacturers of Quarry, Gravel Pit and Mining Machinery



$\frac{3}{4}$   
Cu. Yd.

8'  
Lift

**FRONT END SHOVELS**  
for Industrial Tractors

Write for Catalog

**Elkhart White Mfg. Co. Indiana**

## "FLEX-PLANE" Finishing Machines

AND

Joint Installing Machines

**FLEXIBLE ROAD JOINT  
MACHINE CO.**

WARREN, OHIO

# Clearing House

P&H 600 No. 3053 Shovel, 1 yd., 40' Boom. Good shape, load now, FOB Mo., \$6,000.00.

Thew Lorain 1 1/4 wide Dipper, 32T. Wt. FOB KC. \$4,000.00. Old but good, all gears 90%. Fine for coal or rock.

Byers rebuilt Bearcat Jr., high lift, late model Shovel, air tired factory trailer. FOB KC., \$4,500.00. Ready to go.

We have practically everything you need.

Call Wire Write

**KENNEY MCHY. CO.**

2136 Jefferson, Kansas City, Mo.

## EXCEPTIONAL BARGAINS IMMEDIATE SHIPMENT

FOR SALE:

44C Barber-Greene Ditcher.

10S Koehring Mixer on 2 Pneumatic Tires.

4" Rex Self Priming Pump—Gasoline Power.

FOR RENT:

522 Barber-Greene Pneumatic Tired Bucket Loader—Gasoline Power.

**PAUL L. MATCHETTE COMPANY**

Exclusive Distributors for Barber-Greene Co.

Missouri — Kansas — Oklahoma

20 West 9th Street, Kansas City, Mo.

## TRANSITS and LEVELS

**New or Rebuilt  
Sale or Rent**



**Headquarters for  
REPAIRS — any make.**

**Factory Service.** We will also buy your old instruments or take them in trade.

A complete line of Engineering Instruments and Equipment for Field or Office. Write for Bulletin RS 83.

**WARREN-KNIGHT CO.**

Manufacturers of Sterling Transits and Levels  
136 N. 12th St. Philadelphia, Penn.

## FOR SALE

P&H Trenching Machine. Model 10-30. Digs 13 ft. deep; 30 in. wide. Completely rebuilt.

**THE CHAS. M. INGERSOLL CO.**

19930 Detroit Road, Rocky River, Ohio  
Edison 1010

## • SHOVELS •

2—Model 490 Marion Combination Shovels and Cranes. Electric.

Ward-Leonard Controls.

Each unit complete with 2 1/4 and 3 1/2 yard dipper buckets.

65' Crane Booms.

Rebuilt and Ready to Ship.

—Wire or Write—

**Industrial Equipment Company**

1301 59th Street,  
Emeryville, California

## WANT TO BUY

- 2 Locomotive Cranes
- 2 Whirley Cranes 30' or 125' Boom
- 5 Portable Conveyors 40' to 60'
- 3 1 1/2 to 2 ton Tandem Rollers
- 2 10,000 Gal. Cap. Steel Tanks
- 1 Mile Portable Track

**Leicester Contracting Corporation**  
305 Madison Ave., New York, N. Y.

## FOR LEASE

Ladder Type Barber-Greene Ditching Machine, capable cutting ditch 24 in. wide, 7 1/2 ft. deep. In A-1 condition.

**ROEHL CONST. CO., INC.**

Knoxville, Tennessee

## TIRE REPAIRS

In all sizes of tractor, truck, wheelbarrow, passenger, or 1800x24 tires.

An EQUA-FLEX "Sectional" repair constructed in your tire is guaranteed. Best results and prompt service!

We have a selection of pre-war quality used passenger and truck tires.

**WALLACE TIRE SERVICE, Inc.**

2329 S. Michigan Ave. Chicago, Ill.

**POSITION WANTED** by experienced Const. Supt. and Foreman, 25 yrs. experience in all kinds of paving, dirt moving, also heavy sewer; available Feb. 15th. Sober and dependable; best of references. Box 5000, Roads and Streets, 330 So. Wells Street, Chicago, Ill.

**POSITION WANTED**—As General Superintendent or Superintendent. Have 15 years' experience building all phases of Federal, State, Counties and Cities projects. Airports, Highways, and Street Paving. Heavy and light grading. Concrete bridges, interceptor sewers, water lines, foundations and flood walls. Familiar with modern equipment, and government regulations. Qualifications covers any projects. Organizer and knows cost. Available immediate connection. Age 51. Best of references. Box 1010, Roads and Streets, 330 So. Wells St., Chicago, Ill.

## WE OWN THIS EQUIPMENT! READY FOR IMMEDIATE DELIVERY!!

### CRANES

2—rebuilt P & H Model 200, 3/4 yd. Truck Cranes, tandem drive, pneumatic tired.

1—used P & H Model 600, Shovel Front with 1 1/4 cu. yd. Dipper.

1—rebuilt P & H Model 200, Crawler Crane, 3/4 cu. yd. with 35' boom, in excellent condition.

### BUCKETS

3—new Williams Model 13-M, 1/2 yd. General purpose Clamshell Buckets.

1—new Williams Model 20-X, 3/4 yd. Dragline Bucket.

1—new Williams Model 14-F, 1/2 yd. Clamshell Bucket.

1—rebuilt Page 1 1/4 yd. Dragline Bucket.

1—rebuilt Page 3/4 yd. Dragline Bucket.

### ROLLERS

4—rebuilt Huber 10-ton, 3-wheel, gas engine driven Rollers, rebuilt and guaranteed.

1—rebuilt 5-ton, 3-wheel Gailon gas Roller.

1—rebuilt 4-ton, 3-wheel Fordson Power, Austin Pup Roller.

### WELDERS

10—200 AMP Dual Arc Portable Welders.

1—used 150 amp. Wilson electric Motor Driven Welder.

1—rebuilt 600 amp. gas engine driven P & H Welder.

### GENERATORS

16—new Kohler 1 1/2 KVA, AC, 1500 watt, gas engine driven, 120 volts, single phase, Lighting Generators.

### GENERATORS — Cont.

16—new Kohler, 10 KVA, 240 volts, 3 phase, 60 cycle, gas engine driven Generator Sets, manual control with or without housing.

5—new Lister-Blackstone "Nite Hawk" Portable 5 KW, 120 volts, AC, single phase, 60 cycle, Generator Sets, complete with four 1,000 watt Crouse-Hinds reflectors mounted on 8 ft. telescopic extension mounted on two-wheel spring mounted trailer.

1—rebuilt 50 KVA Superior diesel engine driven Generator, V-belt drive, 220 volts, 3 phase, 60 cycle, AC Generator, 8 power factor, powered with Superior 100 h.p. 6-cylinder diesel engine. Machine in excellent condition.

1—rebuilt 15.7 KVA Superior diesel engine driven Generator, direct connected, powered with 2 cylinder engine, 1200 r.p.m. and Columbia Generator, 220 volts, 3 phase, 60 cycle, .8 power factor. Machine in excellent condition.

### TOOLS

4—rebuilt Cleveland Model H-11 50# Rock Drill.....ea. \$100.00

1—used Cleveland Model H-7, 46# Rock Drill..... 95.00

1—rebuilt Cleveland Model H-77, 58# Rock Drill..... 125.00

1—rebuilt Cleveland Model H-10, 43# Rock Drill..... 125.00

1—rebuilt Cleveland Model C-9 (Demonstrator) 82# Paving Breaker ..... 200.00

1—rebuilt Cleveland Model H-66, 32# Rock Drill..... 125.00

1—used 10-S CMC Mixer on 4 solid rubber tired wheels, with batchmeter and tank..... 800.00

## CHICAGO CONSTRUCTION EQUIPMENT CO.

13912 South Halsted Street

Telephone  
Riverdale 1300

Chicago, Illinois



# New Trade Literature

**Construction Equipment.**—The Construction Machinery Co., Batavia, N. Y., manufacturers of Trojan road tools has issued the folders illustrating and describing the following equipment: Trojan utility patrol, Ragland power drive tamping roller, and the Trojan tamping roller.

**Manganese Steel.**—A 48-page catalog has been issued by the American Manganese Steel Division of The American Brake Shoe & Foundry Co., Chicago Heights, Ill. Divided into sections covering the use of "the toughest steel known" in the blast furnace department, the coke plant, the rolling mill and foundry, the booklet also offers a proved method for successfully reclaiming spindles, crabs and coupling boxes by employing Amsco V-Mang build-up welding rod followed by the application of Amsco Hardface welding rod. Amsco's 400,000 volt X-ray machine one of the largest used in commercial foundries, is described in this book

as one unit of the Brake Shoe's research and inspection facilities.

**Thawers and Heaters.**—The Hauck Manufacturing Co., 124 10th St., Brooklyn, N. Y. has issued a bulletin illustrating and describing its line of thawers and heaters for cold weather operations. These include flame-guns, thawing outfits, superheated steam thawers, concrete heaters, water heaters and salamanders.

## New Manual on Uniform Traffic Control Devices Published

The old manual on Uniform Traffic Control Devices (1935, reprinted 1937), has been superseded by a new "War Emergency Edition" of the same manual, completed recently by a special joint committee of the American Association of State Highway Officials, the Institute of Traffic Engineers, and the National Conference on Street and Highway Safety. The new manual gives special attention to problems of emergency traffic movements, shortages of critical materials, and blackouts. "Division I" covers traffic control devices for conditions of normal lighting, and is essentially a condensation of the earlier manual with such modifications as are dictated by material shortages and special wartime traffic movements. Certain changes are recommended to make normal markings serviceable also under blackout conditions, but compromise signs and signals are not recommended. "Rounded" letters, formerly optional, are now made standard for signs.

"Division II" covers traffic control devices for blackout conditions, based principally on War Department specifications. A supplement on dimouts will be issued as soon as possible.

Appendices include recommendations as to the availability and use of materials, and reprints of War Department blackout specifications.

The manual has been published by the Public Roads Administration of the Federal Works Agency. Only a limited edition is available and distribution will be restricted to traffic officials and others having a direct connection with either the manufacturer or installation of traffic control devices. Requests should be directed to the Public Roads Administration and should indicate the need for the manual.

## THAW CULVERTS AND HYDRANTS WITH AN AEROIL



### No. 98 Portable Steam Thawer

A handy steam plant with a detachable thawing torch. Used by leading Highway Departments for Culvert Thawing. Special Culvert Nozzle (10 ft.) available. Send for WINTER CATALOG No. 2348 including Concrete Heaters, Portable Coil Water Heaters, Thawing Torches, Ground Thawers, Salamanders, Tar and Asphalt Heaters, etc. 1917-1942—25 YEARS OF SERVICE

AEROIL BURNER CO., INC.  
5711 PARK AVE. WEST NEW YORK, N. J.  
Branches: Chicago, San Francisco, Dallas

## NEED A BIG Trailer?

*La Crosse Makes Them  
Up To 200 Ton Capacity—  
\*\* WRITE OR WIRE \*\**

LA CROSSE TRAILER & EQUIPT. CO.  
LA CROSSE, WISCONSIN U. S. A.

## RELIANCE

CRUSHING, SCREENING  
and WASHING UNITS

● Up to 2000 Tons a Day ●

Crushers	Bins	Drag-Lines
Elevators	Pulverizers	"GAYCO"
Sweepers	Feeders	Centrifugal
Screens	Spreaders	Air Separators
Wash Boxes	Kettles	
	Conveyors	

UNIVERSAL ROAD MACHINERY CO.  
Kingston, N. Y.

Canadian Representatives: F. H. Hopkins & Co., Ltd.  
340 Canada Cement Co., Montreal, Que., Can.



VULCAN PAVEMENT AND  
CLAY DIGGING TOOLS

ARE MADE in a complete line of  
sizes to fit all standard compressed air  
hammers.

Send for NEW Vulcan illustrated CATALOG today.

VULCAN TOOL MFG. CO.  
QUINCY, MASS.

ROADS AND STREETS, March, 1943

## SAVE STEPS IN

## Saint Louis

STOP AT HOTEL  
**Bennox**  
DOWNTOWN ON  
YOUR DOORSTEP  
RATES FROM \$3.00



## SAVE Manpower

The answer is the Root F-33 Curved Moldboard Hydraulic Scraper. Fast, Mobile, and easy to operate.



Grading—Shoulder Work—  
Snow and Ice.

### ROOT SPRING SCRAPER CO.

Kalamazoo, Michigan

Builders of Truck Maintenance  
Equipment for more than 50 Yrs.

## SAUERMAN Power Scrapers



Dig and haul  
all kinds of  
material for a  
few cents per  
yard.

Operated  
by one  
man.



ANY SAVING in man-hours on construction work is a direct contribution to the war effort. Sauerman Power Drag Scrapers are chosen for excavating and stockpiling on defense projects because this simple, sturdy equipment has a 30-year record as a saver of labor and time in moving all kinds of earth materials.

Write for Catalog

**SAUERMAN BROS., INC.**

588 S. Clinton St.

Chicago, Ill.

ROADS AND STREETS, March, 1943

## Index to Advertisers

The Dash (—) Indicates that the Advertisement Does Not Appear in This Issue

A		L	
*Adams Company, J. D.	Second Cover	*La Crosse Trailer & Equipment Co.	95
*Aerol Burner Co., Inc.	95	Leicester Contracting Corp.	34
Albi Chemical Corp.	—	Le Tourneau, Inc., R. G.	15
Allis-Chalmers Tractor Division	13	Lima Locomotive Works, Inc.	—
Alloy Steel & Metals Co.	—	*Littleford Bros.	20
American Bridge Company	—	M	
American Cable Division	Third Cover	Mack Trucks, Inc.	51
American Chain & Cable Co., Inc.	—	Macmillan Petroleum Co.	—
American Cresoting Co.	Third Cover	Magnus Chemical Co.	—
American Cyanamid & Chemical Corp.	—	Marion Steam Shovel Co., The	17
American Steel & Wire Company	10	*Marmon-Herrington Company, Inc.	23
Anthony Co.	92	Matchett Co., Paul L.	94
Armco Drainage Products Ass'n.	32	*Michigan Power Shovel Co.	34
Athey Truss Wheel Co.	—	N	
*Austin-Western Road Mach. Co.	6-7	National Automotive Fibres, Inc.	—
Auto Gear & Parts Co.	—	National Paving Brick Association	—
B		Norgahn Co.	—
*Baker Manufacturing Co., The	21	O	
*Barber-Greene Co.	35	Ohio Oil Company, Inc., The	—
Barrett Company, The	55	*Osgood Company, The	86
*Bethlehem Steel Company	1	Osmose Wood Preserving Co.	84
Blackhawk Mfg. Co.	25	*Owen Bucket Co., The	34
Blaw Knox Company	9	P	
Briggs & Stratton Corp.	90	Paris Manufacturing Co., Inc.	—
Brooks Equipment and Mfg. Co.	33	Pierce Governor Co., The	—
*Buckeye Traction Ditcher Co.	22	*Pioneer Engineering Works	93
Bucyrus-Erie Co.	22	Pitman Publishing Corp.	—
*Buffalo-Springfield Roller Co.	—	*Portland Cement Association	18
*Burch Corporation, The	—	Preformed Wire Rope	—
Byers Machine Co., The	90	R	
C		*Rapid Pavement Breaker Corp.	—
Calcium Chloride Association	—	Raybestos Division	—
Chicago Constr. Co.	94	Raybestos-Manhattan, Inc.	—
*Cleaver Brooks Company	30	*Reilly Tar & Chemical Corp.	85
Cleveland Diesel Engine Division	28	Riddell Corp., W. A.	—
Cleveland Rock Drill Co., The	31	Rogers Brothers Corporation	34
*Cleveland Tractor Co., The	51	Root Spring Scraper Co.	94
Colorado Fuel and Iron Corp.	—	Rototiller, Inc.	16
Concrete Cutting Corp.	—	S	
Concrete Surfacing Machinery Co.	—	*Sauerman Bros., Inc.	96
Continental Motors Corp.	—	Schramm, Inc.	83
D		Seaman Motors	—
Deere, John	—	Shannon & Co., J. Jacob	—
Detroit Diesel Engine Division	28	Sheppard Co., R. H.	—
*Diamond Iron Works, Inc.	—	Sinclair Refining Co.	75
Dietz Company, R. E.	26	*Sisalkraft Co., The	—
Dixon Valve & Coupling Co.	26	Standard Oil Company of California	14
E		Standard Oil Company (Indiana)	34
Electric Wheel Co.	—	Star-Lite Co., The	—
Electro Motor Division	28	Stulz-Sickles Co.	81
Empire Electric Brake Co.	12	T	
*Etmyre & Co., E. D.	—	Telford Equipment Co.	—
F		*Texas Co., The	Back Cover
Fate-Root-Heath Co., The	93	Thew Shovel Co., The	3
*Flexible Road Joint Machine Co.	93	Thornton Tandem Co.	—
Foot Company, Inc., The	29	Tidewater Equipment & Machy Corp.	—
Flink Co.	92	Timber Engineering Company, Inc.	62
*Four Wheel Drive Auto Co., The	—	Timken-Detroit Axle Co.	—
G		Timken Roller Bearing Co.	—
*Gallon Iron Works & Mfg. Co., The	5	Toncan Culvert Mfrs. Ass'n.	—
Gatke Corporation	—	Truscon Laboratories	—
Gemmer Manufacturing Co.	—	Tuthill Spring Co.	—
*General Excavator Company	86	U	
General Motors	28	Union Metal Manufacturing Co., The	—
Gohi Culvert Manufacturers, Inc.	—	United States Steel Corp.	10
Grace Mfg. Co., W. E.	—	Universal Atlas Cement Co.	—
Grohne Concrete Products Co.	—	Universal Crane Division	—
*Gruendler Crusher & Pulverizer Co.	92	*Universal Engineering Co.	4
Gulf Oil Corporation	73	Universal Road Machinery Co.	95
H		Universal Unit Power Shovel Corp.	89
Hazard Wire Rope Division	59	V	
*Heltzel Steel Form & Iron Co.	—	Vulcan Tool Mfg. Co.	95
*Hercules Co.	86	W	
*Hercules Power Company	—	Wallace Tire Service, Inc.	94
Hercules Steel Products Co.	88	Walter Motor Truck Co.	8
Hetherington & Berner, Inc.	87	Warren-Knight Co.	79-94
Hi-Way Service Corp.	—	Warsaw Iron Wks.	—
Huber Mfg. Co.	—	*Wellman Engineering Co., The	91
I		Wenzel Tent & Duck Co., H.	—
*International Harvester Company	—	WGB Oil Clarifier, Inc.	27
*Iowa Mfg. Co.	24	Wheeler Lumber Bridge Supply Co.	—
J		White Mfg. Co.	93
*Jaeger Machine Co., The	79-81	Wiley & Sons, Inc., John	—
Jones & Laughlin Steel Corp.	—	*Williams Form Engr. Corp.	36
K		*Wisconsin Motor Corp.	11
Kenney Machy. Co.	94	Wood Mfg. Co.	—
Keystone Asphalt Products Co.	27	Wood Preserving Division Koppers	—
Klauer Manufacturing Co.	—	Worthington Pump and Machinery	60-61
Koehring Company	19	Corp.	—
Koppers Company	—	Y	
*Kotal Company	—	York Modern Corp.	—

\*Advertisers with \* are represented in the 1942 edition of Powers' Road and Street Catalog and Data Book. Please refer to it for additional information on any of their products.

rs  
Issue  
nt Co., 95  
94  
15  
20  
53  
e., 17  
Inc., 23  
94  
34  
Inc.,  
tion,  
86  
84  
34  
93  
18  
85  
34  
96  
16  
96  
83  
75  
ornia, 14  
na), 34  
81  
ack Cover  
3  
y Corp.  
Inc., 62  
o., The  
10  
1  
Co., 95  
Corp., 89  
95  
94  
79-94  
91  
77  
ly Co.,  
93  
36  
11  
Koppers  
achinery  
60-61  
esented in  
Road and  
Please re-  
mation on



**37,500,000 Forty-Hour Weeks  
LOST THROUGH  
INDUSTRIAL ACCIDENTS**

**American Cable TRU-LAY *Preformed*  
...is a SAFER ROPE  
TO HANDLE**

Believe it or not, industrial accidents cost the United States (last year) 37,500,000 forty-hour weeks of productive time. The interest of our national welfare demands that nothing be left undone to reduce this terrific toll. Look: that amount of productive time is enough to build 8 more battleships, plus 40 more destroyers, plus 3600 more bombers, plus 16,000 more tanks. It is your patriotic duty to do everything possible to protect yourself and others from accidents—that we may produce more weapons of victory.

One way many operators have reduced time-out accidents is through the adoption of American Cable TRU-LAY PREFORMED WIRE ROPE. American Cable TRU-LAY is a safer rope to handle because it is preformed. Being preformed, TRU-LAY is flexible, tractable, willing to do what is required of it without crankiness. It resists kinking and snarling and possesses remarkable fatigue-resistance. More than this, broken crown wires in TRU-LAY PREFORMED do not wicker out to jab and tear workmen's hands. That is one of the big reasons why TRU-LAY PREFORMED is a safer rope. For your next line, specify American Cable TRU-LAY PREFORMED. All American Cable ropes identified by the Emerald Strand are made of Improved Plow Steel.

#### AMERICAN CABLE DIVISION

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Tacoma

**AMERICAN CHAIN & CABLE COMPANY, Inc.**

BRIDGEPORT, CONNECTICUT



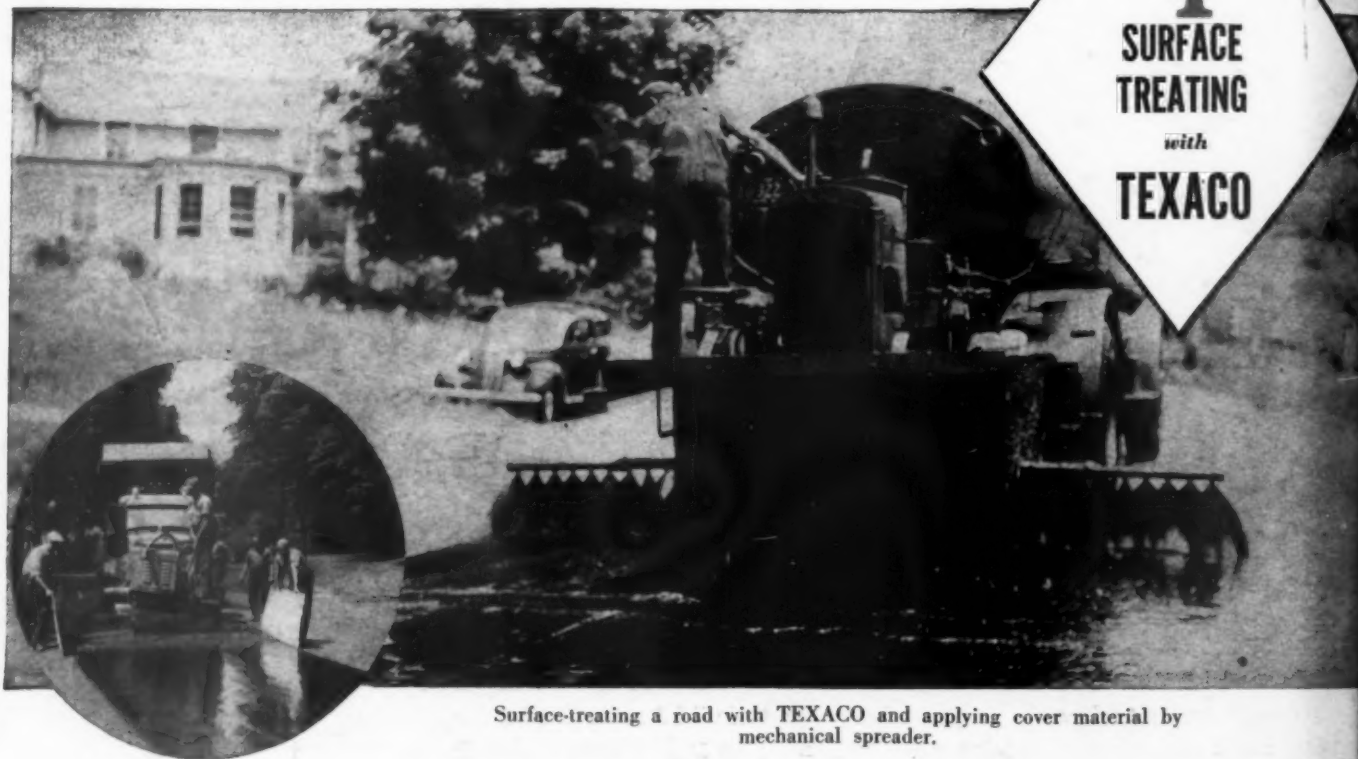
**ESSENTIAL PRODUCTS . . .** TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, AMERICAN CABLE Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, Yacht Rigging, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*



# Your post-war road or street program

A series of advertisements pointing out  
how TEXACO Asphaltic products  
can fit into your program

=1  
SURFACE  
TREATING  
with  
TEXACO



Surface-treating a road with TEXACO and applying cover material by mechanical spreader.



The United States is the world's best-paved nation. Yet thousands of miles of our streets and highways still remain in the "untreated" class—earth, sand-clay, clay-gravel, shale, caliche, gravel, waterbound macadam and similar types.

Until traffic on such roads and streets warrants more durable surfacing, inexpensive measures must be taken to give them waterproof, all-weather surfaces—surfaces which also will protect such roads from abrasion and resulting loss of material.

TEXACO Surface-treatments are the answer. A surface-treatment with the

recommended grade of TEXACO Cut-back Asphalt, Slow-curing Oil, Emulsified Asphalt, or soft Asphalt Cement forms a tough, waterproof, protective carpet, ranging up to  $\frac{3}{4}$  inch in thickness.

A TEXACO Surface-treatment does more than waterproof untreated roads and streets and protect them from abrasion. It also is the first step in "stage construction." It provides an excellent base later on for one of the higher types of TEXACO Asphalt construction, made necessary by increasing traffic.

THE TEXAS COMPANY, Asphalt Sales Dept., 135 E. 42nd St., New York City  
Philadelphia Richmond Boston Chicago Jacksonville Houston

# TEXACO ASPHALT